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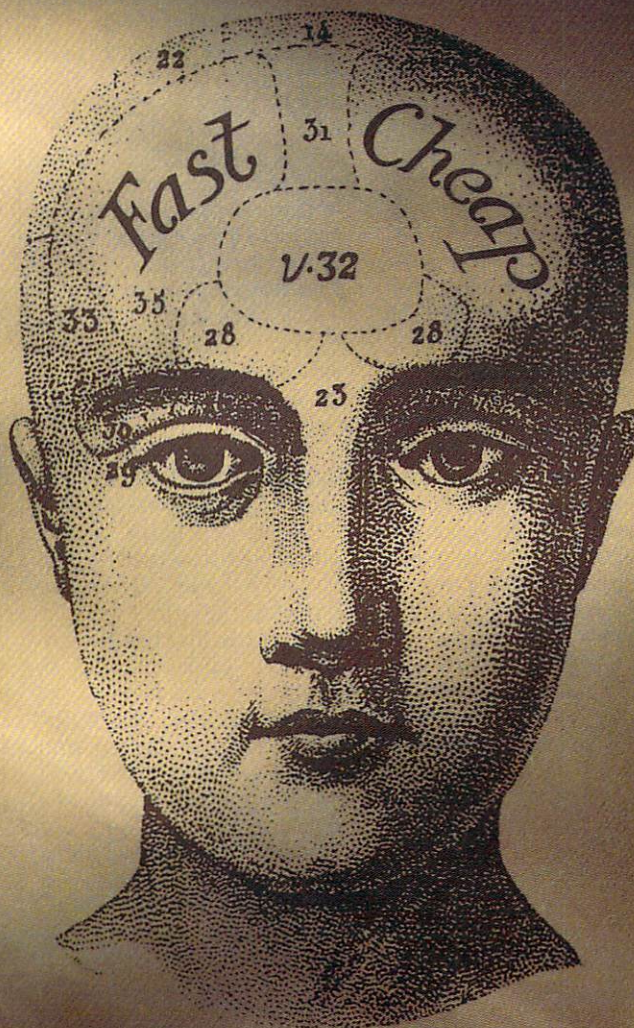


Fig.32

Circle Reader Service Number 192

64/128 VIEW

Most software works as advertised, but some programs do their jobs with elegance.

Tom Netsel

Recently, Larry Cotton, in his "Beginner BASIC" column, offered a two-part series on making programs user-friendly. He discussed ways programs could be designed so computer novices could enter data without crashing the program, entering invalid characters, or becoming confused. That's quite a programming challenge.

It reminded me of a program that was the basis of a computer course I took in college in 1985. The course used a newly released integrated PC program that contained a word processor, spreadsheet, and database management system.

The program wasn't bad. It was reasonably priced, the word processor was great, and I still use the spreadsheet. The database, however, was something else entirely. Does the term *user-hostile* ring a bell?

Let's say you have a database called PEOPLE that consists of a list of friends and relatives and their ages. You also have a field called Holiday. This field has a Y in it if you send the person a card on holidays and an N if you don't send one.

Now, let's say you want to find all the people on your list who get cards and who are older than 20 years old. With this program, you had to go into Edit mode and enter `PEOPLE,HOLIDAY='Y' AND AGE>20,NAME`.

Any BASIC programmer can see the logic behind this command, but you had to know the syntax. You got no prompts, and the punctuation marks were tricky.

Now let's talk user-friendly. In that same year Brøder-

bund released *Bank Street Filer* for the 64.

With its prompts, help screens, and menus, this database program is a snap to use. To conduct a test, I created a similar database on my 64. I then requested a report listing all the people who got cards and who were over 20 years old.

Filer walks you through the process using prompts that are in English. To prepare a report, the program starts *Print every record where* and presents your fields: Name, Holiday, Age. I selected Holiday.

The program then asks *Is, Is Not, Is Before, Is After, Starts With, Ends With, or Contains?* I selected *Is*. The next prompt asks *Is What?* I entered Y for Yes.

Filer then asks *Stop, And, or Or?* Since I had more conditions, I selected *And*. The program then listed my fields for further selection. This time I selected Age, which is a number.

The next prompt offers these choices for numbers: *Is Equal To, Is Not Equal To, Is Less Than, Is Greater Than, Is Zero, Is Not Zero*. I selected *Is Greater Than* and typed 20 at the prompt.

At the top of the screen, my search equation was presented in English: *Print every record where the Holiday field is Y and the Age field is greater than 20*. The program then sorts and prints the report in a variety of possible formats to screen, disk, or printer. It's simple, elegant, and friendly.

When anyone mentions a user-friendly program, I give *Bank Street Filer* a plug. Too bad more programmers haven't copied it. □

GAZETTE

64/128 VIEW

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Why can't more programs be as user-friendly as *Bank Street Filer*?
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Here are some tips
on how to print GEOS documents
on a laser printer—
without owning a laser printer.

LASER PRINTING ON A BUDGET

BY CARLOS AMEZAGA

Desktop publishing really took off when the laser printer arrived.

This advance in printer technology took desktop publishing to new heights, and Macintosh, IBM, and Amiga owners were quick to take full advantage of it. But 64 and 128 owners haven't moved as fast.

Many owners of 8-bit Commodores have been slow to embrace laser technology because they are reluctant to spend ten times the price of their computer for a printer. What many of them don't know is that they can take advantage of laser printing without going to the expense of owning a laser printer. This article will explain how.

Setting Standards

To understand what laser printing is all about, you must remember that when these printers first appeared on the market, they didn't follow any standard. This led to the development of a page description language called PostScript.

This language instruction set tells the laser printer how your image should be printed, what it should look like, and where it should be on the paper. PostScript soon became the standard for most laser printers.

That was great, especially if you were a Commodore GEOS user. When GEOS first came out, Berkeley Softworks provided drivers and fonts so you could buy a laser printer, connect it to your 64, and print. Berkeley published *geoLaser* and special fonts with *geoWrite*. It also released *geoPubLaser* and special fonts with *geoPublish*.

Lasers on a Budget

The technology and software are available for 8-bit Commodores, but there's still one main hurdle blocking the path to laser printing. That problem is price. Laser printers are expensive, and the typical 64 owner does not have that kind of money to pay for a printer. But even on a budget, there's still a way to laser printouts.

The solution was provided by Jim Collette, known as GeoRep Jim on QuantumLink, the Commodore-specific online service. Jim has contributed many programs, both public domain and shareware, as well as his own commercial releases. One of his shareware releases is called *PS.Patch 2.0* and can be found on Q-Link. Rather than being a stand-alone program, this product is a patch, a program that alters another program. It modifies either *geoLaser* or *geoPubLaser* so that instead of sending the required PostScript information to a laser printer, it prints the information to a floppy disk.

Do Me a Favor?

With this information on disk, you no longer need to own a laser printer. If you have a friend who has a PC that's hooked to a PostScript laser printer, all you have to do is transfer the PostScript file from your Commodore disk to an IBM-formatted disk. You can do this with either *Big Blue Reader*, sold commercially by SOGWAP Software, or *Xlink*, which is 128-specific public domain software.

In order to read or write to an IBM-formatted disk, however, you need a 1571 or 1581 disk drive. These are the only two Commodore disk drives that can accomplish such a task. If you don't have either of these drives, there's still a way around this problem. If you have a modem, you can transfer the Commodore file to any other modem-equipped PC.

Check the Yellow Pages

If you're not fortunate enough to have a friend with a laser printer, look in the yellow pages under Desktop Publishing or Printing. In my area there are about four dozen publishers who have IBM equipment at their shops. Some even have a 24-hour bulletin board so you can upload your PostScript file for

printing. They do charge a reasonable fee, but it all depends on the number of pages you're printing out.

How to Do It

Now that you know it can be done, it's time I told you how to create a PostScript file with GEOS. First, we want to check a couple of applications to make sure they are up-to-date. To do this, select the following files from the Desktop, and then select the INFO option from the FILE entry on the top menu. Now make sure that *geoPublish* and the two laser printing applications, *geoPubLaser* and *geoLaser*, have the following dates stamped in their info boxes. Earlier versions have problems.

geoPublish 1.0 10/4/88
geoPubLaser 1.8 8/22/88
geoLaser 2.1 3/10/88

I haven't heard of any problems with *geoLaser* and different dates, but version 2.1 seems to be the most current.

**Laser printers
are expensive, but
there's still
a way 64 owners on
a budget can
get laser printouts.**

If you don't have this latest version of *geoPublish*, you can obtain the most current version of this two-disk program by sending in your disk to Berkeley Softworks, now renamed GeoWorks, and asking for the updated *geoPublish*. You can obtain *geoLaser* or *geoPubLaser*, the 11 laser fonts, and the patch program *PS.Patch 2.0* from Q-Link's software libraries.

Once you obtain *PS.Patch 2.0*, put it on the same disk as either *geoLaser* or *geoPubLaser*. Execute the patch, and you'll get a menu with the option to modify either of the laser drivers. Select the laser driver you wish to modify, and follow the prompts. Once *Patch* has finished running, you'll find a new version of the selected driver on your disk.

Once you have these files patched, all you have to do is load the proper laser printing application. If you created your document with *geoWrite*, then you should use the patched version of *geoLaser*. If you created your document with *geoPublish*, then you must use the

patched version of *geoPubLaser*.

You can use any of the 11 laser fonts within your document. By using these fonts, you'll achieve print comparable to that used in textbooks and magazines. You can also use your regular GEOS fonts, but they'll look jagged in most cases. You can, however, have your GEOS fonts and graphics smoothed as an option to improve their appearance when printed.

Convert to PostScript

Making the PostScript file takes a few minutes. The longer your document is, the longer it'll take to create the PostScript file. You'll also need plenty of free disk space. PostScript files can be very big, possibly taking up your entire 1571 disk or half your 1581 disk, depending on how complex the document is. Since PostScript is a structured language and has about 250 operators, *geoLaser* and *geoPubLaser* have the task of creating another program with this language that the laser printer will understand.

Once you've created your PostScript file and moved it to a PC or Macintosh (which can read IBM disks) by either disk or modem, it's time to print. Dump this file directly to the printer. Do not—I repeat—do not load your file into a word processor! The PostScript file would be corrupted, and it probably wouldn't fit in memory anyway.

Boot a Terminal Program

If you're using an IBM or PC clone, use a terminal program to send the PostScript file to the printer. This will establish a two-way communication channel in case the laser printer encounters any PostScript command errors. If such errors occur, they'll be printed on the terminal screen.

A terminal program such as *Proterm*, *Comterm*, *Procomm*, or *Freeterm* may be used on any IBM or PC clone. Set your communication parameters as follows: 9600 baud, 8 Bits, 1 Stop, No parity, Half-duplex, and Xon/Xoff activated.

Do not under any circumstances use either of the following commands from DOS:

COPY A:filename LPT1

or

COPY A:filename COM1

This doesn't establish a two-way environment and is therefore undesirable.

Dump from a Mac

If you have access to a Macintosh that can read IBM-formatted disks, you

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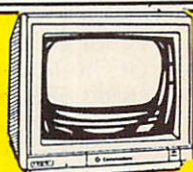
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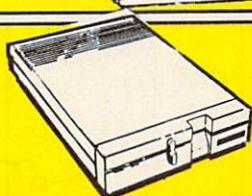
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have the option of dumping the file with a font utility, a program designed to send a PostScript file to a laser printer. There are two that I know of. One is called *SendPS*, and the other is *Font Downloader* from Adobe. *Font Downloader* can be found on font disks that Adobe distributes commercially. *SendPS* is public domain and can be found on GEnie's Desktop Publishing RoundTable. Either of these will do the job for you. You can also use a terminal program on the Mac with the same parameters described earlier. You also have the option of using the Macintosh version of *PageMaker* sold by Aldus.

With an ingenious program by Roger Eller (RogerE5 on Q-Link), we can also load this file into *PageMaker* as an Encapsulated PostScript File (EPF), which is an object oriented graphic file rather than a text file. He discovered that if you add a short list of commands at the beginning of the PostScript file, *PageMaker* will recognize the file as an EPF. By doing so, you can create some stunning effects with commands such as Place, Resize, Condense, and Stretch.

You'll need to play with the PostScript file a bit first. You'll need the *GEOS Text Manager*, a text scrap called EPS Insert Text, and *Wrong Is Write*. *Wrong Is Write* is an application

which will turn your PostScript file into a *geoWrite* document and back again. It can be found on Q-Link, and a more advanced version is sold by Storm Systems. EPS Insert Text can also be found in Q-Link's *GEOS* library.

What you do is convert this true ASCII PostScript file to *geoWrite*. Once it's converted, paste the short text scrap at the beginning of the document; then convert the file back to true ASCII using *Wrong Is Write*. You can then load this modified PostScript file into the Mac version of *PageMaker* and create your own effects. You can then print directly from *PageMaker* instead of dumping the PostScript file to a printer.

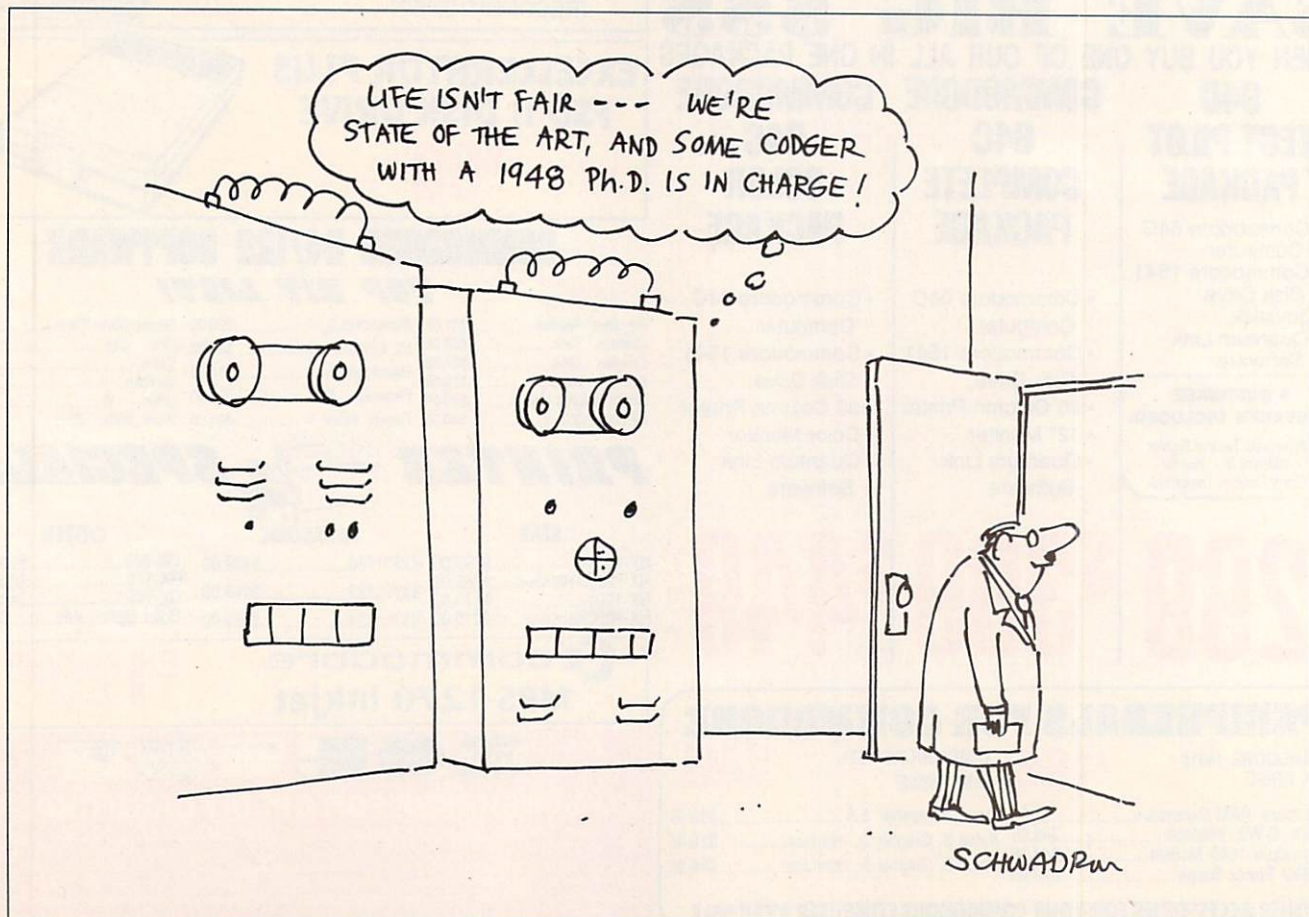
The world of laser printers is within reach of the average 64 or 128 user. Documents generated with *geoPublish* and *geoWrite* are comparable to those created on high-end systems that use gigabytes of memory. With a little time and effort, we can get high-end results on a low-end budget.

Carlos Amezaga invites your comments or questions. His address is 1330 SW 97th Avenue, Miami, Florida 33174. He can also be reached online. He is The Smee on Quantum-Link, C.Amezaga on GEnie, and Carlos Amezaga 135/10 on Fidonet. □

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REVIEWS

THE UNTOUCHABLES

Chicago, 1931. The dark streets of this city are not a safe place to be! Al Capone and the Mob have invaded this area for their own unscrupulous and illegal dealings. It's up to you to free this city from their control.

Ocean of America's *Untouchables* (distributed by Electronic Arts) puts you in control of Elliot Ness and his team of crimebusters. Get plenty of rest now, because you'll need your strength and your mission won't be easy!

Like the popular movie of the same name, this arcade game is full of action and danger. You must complete six very difficult levels to win this game. These levels are called Warehouse, Bridge, Alleys, Train Station, Hostage, and Rooftop. At each level, you must accumulate points and evidence. This is not easy. For example, at the Warehouse level, gangsters are trying to kill you as you search for the Mob's bookkeepers. You want their books, but they're armed and not about to cooperate.

Time is another factor that can affect your success. Each level must be completed in a certain amount of time. Using the Warehouse level once again as an example, once you kill a bookkeeper or make him drop his evidence, you have only a short amount of time to pick it up.

As the game begins, you are at the bottom level of the Warehouse. You must engage in a surprise attack on Al Capone's bootlegging operation to get the necessary damaging evidence from his bookkeepers' ledger pages. An arrow displayed at the top of the screen tells which direction to move to find

these bookkeepers with the evidence. But watch out! Gangsters move in quickly to stop you as you chase these fast-moving bookkeepers.

Station, has your Untouchable character guiding a runaway baby carriage away from gunfire and dangerous obstacles. If innocent civil-

the second or third level.

The documentation for this game is brief, but it provides you with all the information you need to begin playing. Instructions are straightforward and easy to comprehend. Each level of play is described in enough detail to help you understand what you will be up against. This documentation also includes some useful tips on playing. The game's main idea is not that original; it's simply good guys versus bad guys. However, I liked the challenge involved in defending myself against the gangsters while searching for the evidence, as opposed to just worrying about being shot.

The Untouchables also makes good use of the 64's graphics and sound capabilities. Graphics were displayed on the screen in much detail. The background music was pleasant and set the mood for action.

This game is entertaining, and its level of difficulty only makes it more of a challenge to play. So, if you like a real challenge, this game will give you hours of enjoyment as you visit Al Capone's Chicago of the 1930s.

Chicago, 1991. Sixty years have gone by, and the streets are much safer now. Al Capone's reign of terror is but a distant, unpleasant memory. Unfortunately, Elliot Ness and his brave heroes are also relegated to the past, but with your 64, you can go back to the era of the *Untouchables* and relive their fight against crime.

CHRIS STAWASZ



Help Elliot Ness get the goods on Al Capone and his Mob.

You get points for killing gangsters. You can also acquire additional weapons and ammunition or extra energy in some cases. However, cornering the bookkeepers is more important, since you collect a certain percentage of the necessary evidence from each one. If you accumulate 100 percent of the evidence before the time limit expires, you move to the next level, the Bridge.

At the Bridge, Capone's men are attempting to cross the Canadian border to safety and must be stopped. Again, you must kill the gangsters to collect the necessary evidence. At this level, you should probably select a different Untouchable character, since your current one is getting weak.

In the next stage, the Alleys, you must collar Capone's accountant with the evidence before he skips town on a fast train.

The fourth level, the Train

Station, has your Untouchable character guiding a runaway baby carriage away from gunfire and dangerous obstacles. If innocent civil-

ians are accidentally shot, your character loses energy. At the fifth level, only one of Capone's men is left, and he decides to take someone hostage. React quickly, since you only have five seconds to kill the gangster.

The final level is the Rooftop. With all the evidence you have collected against Capone, he has been indicted. However, you must now dispose of Capone's hitman. Manage this, and you'll win the game.

The Untouchables is easy to understand. There's no problem figuring out what moves to make and how to play it. However, I did find it very difficult to get to the higher levels of the game. With practice, my score gradually improved. This game definitely takes a lot of practice to reach the upper levels. Learning the detailed layout of each level can help, but I think the average player will have problems just getting to

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B.A.T.

If you're looking for a science fiction role-playing game that takes the genre to its limits of creativity, originality, and fun, then check out *B.A.T.* I've never played a stranger sci-fi game.

The designers of *B.A.T.* worked hard to produce a game that's unique in every aspect. They succeeded and went beyond this goal to create a game that's as much fun to explore as it is to solve. Although *B.A.T.* takes many hours to finish, it's also fun just to explore the game's more than 1000 locations that vary from bars and offices to apartments and caves. *B.A.T.* comes from UBI Soft in France, and its European feel contributes a great deal to the game's effect on its players.

First of all, *B.A.T.* stands for the Bureau of Astral Troubleshooters, a group of galactic police officers whose job is to investigate problems and maintain order. Just don't make the mistake of pronouncing the acronym *bat*.

Your character is a new agent brought into the *B.A.T.* organization to capture Vrangor, a dangerous scientist, and his sidekick Merigo. Both of them recently broke out of prison. The two troublemakers have threatened to destroy the large city of Terropolis on the planet Selenia if their demands are not met. Although you have to work fast to find and neutralize Vrangor and Merigo, the story moves you along so you can perform crucial actions at the right times. There is plenty of time to explore Selenia, and it's important to look for clues and to familiarize yourself with the game.

The first step in *B.A.T.* is to create a character. Your persona can have many charac-

teristics and abilities to accurately represent you in the game. The development of characters in *B.A.T.* is one of the most comprehensive and complete systems in the RPG field. Your character possesses various competencies and aptitudes, some of which are modifiable during character creation.



Menus and windows in *B.A.T.* simplify gameplay and help you explore more than 1000 different locations.

Six areas of competence which may not be modified are life percentage remaining, level of knowledge, experience, calorie requirements, hydration requirements, and credits (money). The six modifiable characteristics are force, intelligence, charisma, perception, vitality, and reflexes. Various aptitudes include such skills as climbing, vigilance, and psychology. As you can see, a character in *B.A.T.* can be well developed.

There are enough places to visit and enough miniquests to solve in *B.A.T.* so that all of your character's competencies and aptitudes gain real meaning at one time or another. Another nice touch is the chart that visually represents these characteristics and abilities on the character screen.

B.A.T. uses menus and icons for gameplay. You can select the main menu with the cursor to access the necessary commands and also click directly on the screen to gain information about objects, talk with characters, and use exits. The interface is dynamic and combines the menu commands and

clickable icons to make gameplay effortless. The manual explains all of the menu commands and subcommands and shows the menu levels in detail. There are only a few main commands, but they cover everything your character does in the game.

Two other parts of the interface further confirm the uniqueness of *B.A.T.* These are B.O.B., a bidirectional organic biocomputer, and the DRAG, a vehicle you use to travel around Selenia.

B.O.B. is attached to your character's arm, and it performs several important functions. It can list your alter ego's characteristics and physical condition and can modify heart rate. Perhaps more important, B.O.B. can be programmed with a simple command language to perform some functions auto-

matically, such as alerting you when Vrangor or another enemy is near or automatically translating languages of aliens during conversations. B.O.B. is very useful in *B.A.T.* and further develops the game universe.

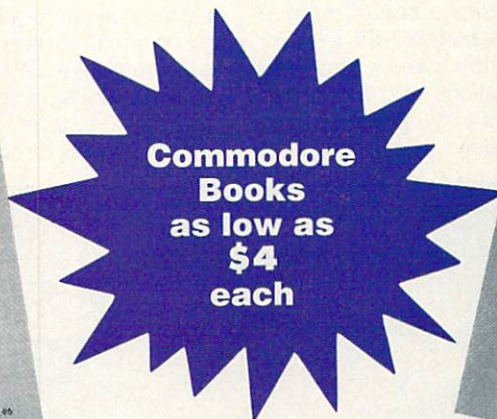
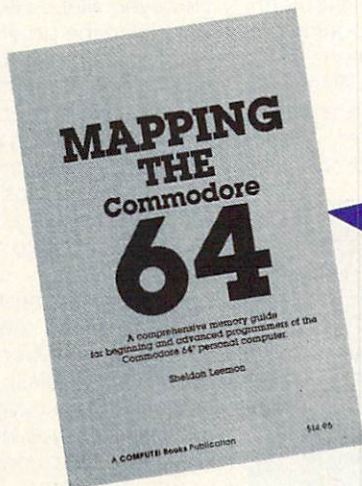
The DRAG is a simple flying machine that adds 3-D flight simulation to *B.A.T.*'s already complete interface. It's tough to fly, but it does carry some formidable weaponry. You need DRAG to reach certain locations in the game, and it expands your character's mobility.

The graphics in *B.A.T.* are impressive. The locations are detailed and colorful, and you can access most areas of the picture with the menu commands. When you enter small rooms or other locations, *B.A.T.* pops up a window for that location rather than clearing the screen. This windowing trick maintains itself because there are only a few windows on-screen at any time. This feature provides the player with a partial view of previous locations and simplifies visualization of the game world. The 3-D view from the DRAG ship works well on the 64.

Movement is fluid, and the flying machine adds yet another level of fun to this game. *B.A.T.* is one of those gems that you might normally miss because it comes from a small software company and has a strange name and box cover. The game presents science fiction in a way that any fan will devour. The variety of weapons, alien races, locations, and objects populating the game adds the finishing touch of realism to this future world.

B.A.T. lets you move at your own pace to explore the game world and enjoy all that it has to offer. You can continue to enjoy the game

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even after you eliminate Vran-gor and Merigo. With its dynamic environment, *B.A.T.* offers the sci-fi fan a world as detailed as a book and as visual as a motion picture.

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METAL GEAR

Rockets, rations, handguns, oh my! *Metal Gear* from Konami has all this and more. This arcade/action game tosses you into the heat of combat as a one-man army sent to stop the insane Col. Vernon CaTaffy from taking over the world. Here's a chance to see if you've learned anything from all those Stallone and Schwarzenegger movies.

CaTaffy has set up a vast compound in Outer Heaven, a small nation in Africa that houses his worst creation, the ultimate weapon—Metal Gear. As Solid Snake of the covert unit Fox Hound, you must infiltrate the enemy compound; collect weapons, ammunition, and other useful objects; and then destroy CaTaffy's powerful device.

Metal Gear is an average game that doesn't excel in any particular area, except perhaps fun. For its price, the game is an absolute steal and will keep you occupied for hours.

Metal Gear's main screen has a three-quarter perspective view through which your character moves. If you hit any key other than the space bar, a menu pops up providing you with various choices for the weapons screen, equipment screen,

or communications screen.

The first two screens show pictures of all the weapons and objects that you possess. Select one of them or a blank position with a cursor to exit the screen. The communications screen provides access to your transceiver, the means to communicate

fisted variety in *Metal Gear*.

The graphics are average for a 64 game. You can easily distinguish the objects and floor layout, but the colors on most screens are a drab green-blue. What *Metal Gear* lacks in splashy graphics, however, it more than makes up for in music



You must capture weapons and equipment if you hope to foil Col. Vernon CaTaffy's evil plan to conquer the world.

with home base for helpful hints and messages. The space bar switches between your fist and the current weapon. The gameplay in *Metal Gear* is simple. You move around the buildings and outdoor areas of the compound, trying to find better weapons and special objects that'll get you past obstacles and traps.

Konami includes a map of all game screens along with the well-written manual in the package. Although it felt like cheating to use the map, I found it very helpful in some places. Even with the map, *Metal Gear* is still challenging and fun. Your heart will still be pounding by the time you get to the final level of buildings. With well over 100 screens, there's a lot of two-

and sound effects. The music is catchy and fast and continues throughout the entire game. Sound effects are not as impressive, but the explosions and gunfire still get the point across. The music heightens the intensity in the game more than any other feature.

One big problem with *Metal Gear* is disk access. Every two or three screens and every time you go into a room or other enclosure, the screen blanks, and the drive starts spinning. This becomes so annoying that I frequently take a break and leave the game. Other arcade games of the same complexity have tackled this problem in the past.

Metal Gear's method of saving games is also awkward.

The save-game feature is very important for a game as large as this one. However, *Metal Gear* saves directly to the program disk, and I often had problems restoring games. In the end, I had to start all over. For this reason, I decided to play *Metal Gear* in one sitting rather than chance losing my place. It's always a bad idea to save games to the program disk.

The variety of neat objects and compound rooms kept my interest in *Metal Gear*. From a bomb blast suit and compass to an oxygen tank and flashlight, you intelligently use objects to conquer the terrain and traps. This element of *Metal Gear* elevates the game above the bevy of military shoot-'em-up clones to a category reserved for better action games.

One hint to keep you awash in ammunition is to take note of all places where you find bullets and such. When you leave the room and reenter, you'll find a fresh supply of ammo in the same place. I don't know if this is a glitch in the program, but it certainly keeps me from running out of both rations and ammo.

If you like games with a lot of action and strategy to boot, *Metal Gear* is worth your money and efforts. The game lasts longer than its monetary equivalent in movies and puts you in charge of all the action.

Now go get CaTaffy before he eliminates what's left of the world! And watch out for those land mines!

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REVIEWS

GATEWAY 64

CMD says *gateWay* represents a "new philosophy with working with GEOS." It's not kidding.

Unlike some alternative deskTops, *gateWay* is a full GEOS replacement. The first thing you do is create a new boot disk customized to your setup. This includes a device driver for each of your disk drives, your printer, and your input device. Once you've done this, you boot up into a different world.

Fortunately, this world runs by familiar GEOS rules. Gadgets on the screen are intuitively designed. Files are listed by name in a resizable window from which they can be selected and maneuvered with a mouse click.

On one side of the filenames is a slider to move quickly through a directory. On the other side a "fuel gauge" shows how much of the disk is filled. If you need to be more exact, a click on the gauge opens a window of disk information. Keyboard shortcuts are pretty much the same as with GEOS. *GateWay* operates with exceptional smoothness; the entire directory is in memory at once, which speeds up scrolling.

Basically, these changes are cosmetic, but there are some real improvements that make *gateWay* shine. The program supports three active drives at one time if you have a RAM expansion unit (REU). It also has a trash can system which allows you to toss unwanted files into an alternate menu, but if you change your mind, they can be reinstated. But *gateWay* really jumps ahead of the deskTop and stock GEOS when it comes to supporting disk drives. It offers device drivers not only for 1500-series drives, but for CMD hard drives, all REUs (including geoRAM and the 1700), and CMD's new RAMDrive and RAMLink systems.

Also included is a RAM disk driver which takes advantage of any extra memory you may have installed. If you operate GEOS with anything more than a floppy drive or two, *gateWay* will finally allow your system to run instead of walk. If you have at least 512K RAM on board, *gateWay* flies. Using a 64K area of RAM, the system offers a task-switching device called the Switcher. Press two keys, and you can jump instantly between two applications. This



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is one of the most exciting features of *gateWay*, but it works only if you have a lot of extra RAM installed.

Features like full three-drive support also require an REU. This program is designed for the user with an expanded system. If that's you, *gateWay* is a must.

The more you have for *gateWay* to play with, the more powerful the system becomes. You can modify your version of *gateWay* with a new file type called a Gate-way Document. This is essentially a separate but compatible program which can be integrated into *gateWay* to provide additional options. Several such documents are provided as examples.

You'll find *gateWay* works

well with various disk drive combinations. Without extra RAM, however, different models can only communicate for basic file copying.

GateWay cheerfully runs almost any application or desk accessory written for *GEOS*. To ensure compatibility, CMD has provided a driver which configures the REU to emulate the 1541/1571 drive supported by *GEOS* itself. The manual is well written, despite a few errors resulting from last-minute changes in the software.

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Plotting Equations

Is it possible to get a hi-res program with a PLOT X,Y function for the 64, which will rapidly plot equations on x- and y-coordinate axes?

FRANK GORDON
ORONO, ME

Here's a very simple routine in 64 BASIC that will plot a sine function. The program asks for upper and lower bounds which are the amplitude of the sine wave. No matter what amplitude you select, the program will scale the sine wave to fill the screen. For brevity, finer points (such as adding values and tick marks to the axes, providing text on the screen, and error checking for infinities) have been omitted.

When you run the program, it asks for a lower and upper bound. For a demonstration, enter -6 and 6 and then experiment with other values. Press any key when the program finishes. Type RUN for another plot. A machine language routine lets you go to bitmap mode (clearing the bitmap screen as it does so), return to text mode, and clear the bitmapped screen independently of modes.

```
SH 100 AD=49152
CX 110 READ XX:IF XX>=0
{SPACE}THEN POKE
{SPACE}AD,XX:AD=A
D+1:GOTO110
JJ 120 INPUT"WHAT IS THE
LOWER BOUND";X1
FC 130 INPUT"WHAT IS THE
UPPER BOUND";X2
CJ 140 PRINT:PRINT"PLEAS
E WAIT";
DX 150 XX=X1:GOSUB 310:Y
1=YY:Y2=YY:RX=319
/(X2-X1)
KF 160 FOR XX=X1 TO X2 S
TEP 1/RX:PRINT"."
::GOSUB 310
MJ 170 IF YY<Y1 THEN Y1=
YY
EQ 180 IF YY>Y2 THEN Y2=
YY
AE 190 NEXT:RY=199/(Y2-Y
1)
CJ 200 SYS 49152:REM GO
{SPACE}TO BITMAP
```

```
SJ 210 IF X1<0 AND X2>0
{SPACE}THEN XX=-X
1*RX:FOR YY=0 TO
{SPACE}199:GOSUB
{SPACE}290:NEXT
SC 220 IF Y1<0 AND Y2>0
{SPACE}THEN YY=-Y
1*RY:FOR XX=0 TO
{SPACE}319:GOSUB
{SPACE}290:NEXT
KF 230 FOR X0=X1 TO X2 S
TEP 1/RX
BB 240 XX=X0:GOSUB 310:X
X=(XX-X1)*RX:YY=(
YY-Y1)*RY:GOSUB29
0
MB 250 NEXT
KS 260 GET A$:IF A$="" T
HEN 260
DB 270 SYS 49152+3:REM R
ECOVER THE TEXT S
CREEN
MH 280 END
EX 290 Y0=199-YY:AD=8192
+INT(Y0/8)*320+IN
T(XX/8)*8+(INT(Y0
) AND 7)
PE 300 POKE AD,PEEK(AD)
{SPACE}OR (2^(7-(
INT(XX) AND 7)))
RETURN
FX 310 YY=SIN(XX):RETURN
XH 320 DATA 76,13,192,76
,74,192,76,83,192
,6,7
ER 330 DATA 0,0,32,108,1
92,32,83,192,173,
9,192
KS 340 DATA 141,32,208,1
62,4,134,252,162,
0,134,251
BD 350 DATA 160,0,173,10
,192,10,10,10,10,
13,9
RX 360 DATA 192,145,251,
200,166,252,224,7
,240,9,192
CG 370 DATA 0,208,243,23
0,252,76,45,192,1
40,11,192
XQ 380 DATA 174,11,192,2
24,232,208,228,96
,32,139,192
GH 390 DATA 169,147,32,2
10,255,96,169,0,1
33,251,169
DJ 400 DATA 32,133,252,1
69,0,168,145,251,
200,208,251
HC 410 DATA 230,252,166,
252,224,64,208,24
3,96,173,17
QB 420 DATA 208,9,32,9,1
6,141,17,208,173,
22,208
XX 430 DATA 24,41,223,14
1,22,208,173,24,2
08,24,41
HB 440 DATA 240,9,8,141,
24,208,96,173,17,
208,24
```

```
GG 450 DATA 41,223,141,1
7,208,24,173,24,2
08,24,41
DE 460 DATA 240,9,6,141,
24,208,24,173,22,
208,41
AC 470 DATA 239,141,22,2
08,96,-99
```

Lines 100 and 110 poke the machine code into the RAM window above BASIC. Lines 120 through 190 do scaling calculations based upon the starting and ending values of the functional argument. Line 200 sets the bitmap screen with SYS 49152.

Lines 210 and 220 draw the axes if they're part of the region being examined. Lines 230-250 construct the actual plot. Lines 260-280 wait for a keypress, return to the text screen with a SYS 49152+3, and end the program.

Lines 290 and 300 are a subroutine for setting the pixels pointed to by variables XX and YY. Line 310 is the actual location of the function where YY receives the value of the function when XX is used as the argument.

The remainder is machine code data. If you want to clear the bitmap, type SYS 49152+6. If you want to change the background color, type POKE 49152+9, backcolor. To change the foreground (plot) color, use POKE 49152+10, forecolor. Backcolor and forecolor represent the numeric values (0-15) of the 64's 16 colors. Pick the combination you prefer.

In addition to writing your own code, many programs are available which do graphing as a specialized talent or as an enhancement to BASIC. These can be obtained commercially, from the public domain, and as shareware. Check software stores, mail-order houses, user groups, online networks, and, of course, COMPUTE magazine.

Questions and
answers
about plotting
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Intelligent Use

As newcomers to the world of computers, our family is using our 64 as a game machine. Can you direct us toward information on how to begin making intelligent use of our computer? Also, where can we get public domain programs?

JANE TENBRINK
SHELBY, MI

That's a tall order for this column, but you might start by reading every back issue of Gazette you can get your hands on. We've always tried to provide a mixture of entertainment and productivity articles in Gazette to help Commodore users get the most from their machines. To get started, however, invest in the Big Three productivity software packages: a word processor, a spreadsheet, and a database program. These will let you write practically any type of document that you might use around the home or office, keep financial records, and manage other data, such as lists, club memberships, inventories, collections, or what have you.

A modem and terminal program are also good investments as they can enable you to contact other computers in your town or across the world. Electronic bulletin boards are great sources of public domain and shareware programs. You can also find PD software by looking through advertisements in the back of this magazine. There usually are a number of good sources listed. A user group is another excellent source. User group members will be glad to share their knowledge of computers with you and your family.

Transparency Labels

Can anyone tell me where to find some pin-fed label stock for photographic slides? I've

seen some programs for printing them, but I can't seem to find any here in the San Fernando Valley.

B. CHANDLER SHAW
GRANADA HILLS, CA

Check with any large office supply store in your area and ask for an Avery label, stock number 7207. These labels are 1½ x ¾ inches, pin fed, but designed to stick to cardboard rather than plastic slide mounts. You can call (800) 843-2347 for the name of the dealer nearest you or write to Avery-Dennison, 850 East Algonquin Road, Schaumburg, Illinois 60173.

Dial This Number

In "Beginner BASIC" (April 1991) you featured "Your 64 as a Digital Dialer." The article failed to include the tone information for a touch-tone telephone's * and # keys. Could you provide these, please?

RICHARD C. KIRK
NICEVILLE, FL

The telephone dialer program omitted the star () and pound (#) signs and the ability to insert a pause during the dialing process. To add these features to Larry Cotton's program, the author suggests the following changes.*

Add these lines:

```
25 DIMW(4,12)
291 IFDS(N)="P"THEN FOR-
DE=1TO1000:NEXT
292 IFDS(N)="*"THEN DS="10"
293 IFDS(N)="0"THEN DS="11"
294 IFDS(N)="#"THEN DS="12"
```

Change lines 150-180 to read as follows:

```
150 FORN=10TO12: W(1,N)=77:
W(2,N)=60: NEXT
160 FORN=1TO10STEP3:
W(3,N)=121: W(4,N)=77: NEXT
170 FORN=2TO11STEP3:
W(3,N)=156: W(4,N)=85: NEXT
180 FORN=3TO12STEP3:
W(3,N)=165: W(4,N)=94: NEXT
```

Delete line 190 in the original program listing.

To test the program, you'll need to increase the length of tones in line 240 and change the first test data item in line 390 to read as follows.

240 Z=150
390 DATA JIM, *0#-1P11

Be sure to use the capital P to insert a pause. To change pause length, adjust the length of the time-killing FOR-NEXT loop in line 291.

Gee, It's GEOS!

The August issue of COMPUTE arrived yesterday, and I just have to write and tell you how much I enjoyed the premiere of the long-awaited GEOS column by Steve Vander Ark. I hope that it will become a permanent feature in the Gazette section.

My cup runneth over! There was even a great GEOS type-in program for creating an animated mouse pointer. The talent and creativity of your program authors never cease to amaze me.

ROBERT NELLIST
BROCKPORT, NY

In our recent survey, many readers indicated that they wanted more GEOS information, articles, and programs. In an effort to fill this request, Gazette contacted Robert Nellist, who himself is no GEOS novice. (See his review of GEOS Font Editor.) Robert recommended Steve Vander Ark. For the past few months now, Steve's "GEOS" column has appeared in Gazette, and we think he's doing an outstanding job. If you have any GEOS-related questions or topics you'd like to see him cover, drop Steve a line in care of the magazine. You can also leave E-mail for him on QuantumLink, where his handle is SteveV14.

**Where to find
labels for
photographic slides,
more about
the Digital Dialer,
and thanks
from a GEOS user**

MACHINE LANGUAGE

Jim Butterfield

FIXED POINT NUMBERS

We can often handle fractions without the complexity of floating point. Even BASIC sometimes has trouble with floating point. Try entering PRINT 8.13 and see what happens when you press Return.

Fixed point notation uses an assumed decimal point. A value of 12345 might be used to represent an amount of \$123.45; a value of 45678 might represent a distance of 45.678 meters or, if you like, 45678 millimeters. Thus, values that we think of as fractions can be held as integer values. This simplifies the arithmetic. Even nonmetric values can be stored this way: 876 ounces represents 54 pounds, 12 ounces (dividing by 16 is easy in binary).

Here's a simple program to keep a monetary value as binary cents. To keep the coding compact, we'll hold the value in two bytes, 16 bits. That limits us to a maximum amount of \$655.35; a practical program would use at least three bytes or more. (Three bytes would hold amounts up to \$167,772.15).

The program will start with three cents (binary 3) and double this value nine times. Each value will be printed on the screen; you'll see how the decimal point is inserted.

You may load and run the BASIC driver program given below. The full machine language code won't be shown; instead, I'll note highlights.

Our main program is at hex address 2000; it sets up the loop to print the ten values. The loop calls the subroutine at \$200B, which, in turn, calls the display value subroutine and then doubles the binary value at \$2100 and \$2101 with an ASL (Arithmetic Shift Left) and ROL (ROTate Left).

The display routine starts at \$2015. Its job is to convert the binary value into decimal so that it can be displayed. To do this, we use a clever procedure involving decimal mode. An area is set aside to hold the decimal value, originally 0. Bits are extracted from the binary number, one at a time. The decimal value is doubled by adding it to itself; the binary bit is added in automatically. When you've handled all the binary bits, the decimal area will contain the decimal value in BCD (Binary Coded Decimal). This coding is worth a look, if you haven't seen it before. Note that the binary number from \$2100/1 has been copied to \$2102/3.

```
0202C 0E 03 21 ASL $2103
;low byte
0202F 2E 02 21 ROL $2102
;high
```

The highest bit of the binary value will have been shifted into the Carry flag. If the Carry flag is set, the add that will take place soon will have an extra value of 1 added in.

```
02032 78 SEI
02033 F8 SED
02034 AD 06 21 LDA $2106
02037 6D 06 21 ADC $2106
0203A 8D 06 21 STA $2106
```

And it goes on, doubling the higher byte values at \$2105 and \$2104 by adding them to themselves. We'll skip those instructions and just note that we must clear decimal mode. We have locked out the interrupt because some early machines would get muddled on their keyboard scan if decimal mode were set.

```
0204F D8 CLD
02050 58 CLI
```

The above shift-binary, add-decimal is repeated 16 times, once for each bit of the bina-

ry number. Now we have the decimal digits, packed two to a byte; all we need to do is to print them, slipping in a decimal point at the right place. I've included zero suppression code; look for it.

Once you understand the principles involved, fixed point decimal seems natural. Use your monitor to snoop through all the code. Then you'll be ready to take on a similar job of your own.

This program will run on most any 8-bit Commodore computer. The code begins at hex address 2000—not the most convenient location, but it's an area of memory that's readily available on most Commodore machines.

```
100 DATA 162,0,32,11,32,232
110 DATA 224,10,208,248,96
120 DATA 32,21,32,14,1,33
130 DATA 46,0,33,96,173,0
140 DATA 33,141,2,33,173
150 DATA 1,33,141,3,33,160,0
160 DATA 140,4,33,140,5,33
170 DATA 140,6,33,14,3,33,46
180 DATA 2,33,120,248,173,6
190 DATA 33,109,6,33,141,6,33
200 DATA 173,5,33,109,5,33
210 DATA 141,5,33,173,4,33
220 DATA 109,4,33,141,4,33
230 DATA 216,88,200,192,16
240 DATA 208,214,169,48,141
250 DATA 2,33,173,4,33,32
260 DATA 123,32,173,5,33,32
270 DATA 123,32,169,46,141
280 DATA 2,33,32,210,255,173
290 DATA 6,33,32,123,32,169
300 DATA 13,32,210,255,96
310 DATA 72,74,74,74,74,32
320 DATA 136,32,104,32
330 DATA 136,32,96,41,15,9
340 DATA 48,205,2,33,240,5
350 DATA 206,2,33,16,2,169
360 DATA 32,32,210,255,96
400 FOR J=8192 TO 8347
410 READ X:T=T+X
420 POKE J,X
430 NEXT J
440 IF T<>12136 THEN STOP
500 REM Need to poke the
    initial value of three cents
510 POKE 8448,0:POKE 8449,3
520 SYS 8192
```

Working with fixed point numbers is simple in machine language. All you need to know is where the decimal point should go.

Steve Vander Ark

GEOWRITING MADE EASY (ALMOST)

I'm a fan of *geoWrite*. The other day a guy I know called it *geoWrong* and proceeded to bombard me with a rather daunting list of evidence to back up his contention. I didn't listen; I figured that attack was caused by something disagreeable he ate for breakfast or the fact his wife had seen the bill he ran up last month on Q-Link. I think *geoWrite* is wonderful.

Oh, I know—you don't read this column just to hear me gush, but I have a real affection for proportional fonts and WYSIWYG (What You See Is What You Get). Since my first printer (a used Okimate 10) and my first GEOS package (1.3) arrived at pretty much the same time, *geoWrite* was really the first word processor I ever used. Now, I'm used to the program, and many of us like what we're used to.

To be fair, my friend's objections to *geoWrite* do have merit. It is a bit slow, and it's prone to dropping characters here and there if you really get cooking at the keyboard. When it redraws the screen—which is quite often—it's certain to miss a few keystrokes. In 40 columns, the side-to-side flipping as you cross the page can frustrate even a confirmed *geoNut* like me.

There are no global settings available, so if you decide to change fonts or margins on a multipage document, you're in for a rather monotonous process. You make the changes, watch the whole thing reformat itself, and then try to find the bits of text that slipped through at the page breaks with the old formatting. When that's finished, you're forced to print using GEOS fonts, wheth-

er or not they're appropriate for the document in question, or use the NLQ setting but forgo any style changes such as boldface or italic.

All this might convince you to try a more conventional program and avoid the hassles, but there are some big advantages to a word processor like *geoWrite*. For one thing, you can see what you're doing. The text appears on the screen in all the places and in all the styles that will print on your finished document. This makes formatting a breeze, and since you can preview your text onscreen, it saves a good deal of printer time and paper as well.

You really appreciate this if you ever need to create a page with some unusual spacing and formatting. With a conventional word processor you might spend the entire evening trying to get the right combination of cryptic codes in the right places to make the whole document look like you want. But with *geoWrite*, it happens right there on the monitor's screen as you type, indentations and all. You hardly need to print anything until you are certain that it's what you want and perfect.

The fonts you can use are another benefit of *geoWrite*. They range from businesslike to fun—and they're proportional, as well. As I mentioned in last month's column, you can even overcome the blocky curves and angles inherent to bitmapped fonts with the right printer driver.

Screen redraws will still make *geoWrite* stumble. You can overcome most drawbacks by using only one font for typing the entire document, adding special effects and other fonts only after the document's in shape and ready for the printer. The built-in font, BSW, works fine for this, but I like to use a 10- or

12-point font such as LeConte or University because it's easier to read on my screen. But keep to a smaller point size; the screen redraws only when it's filled with text, after all.

Side flipping can be eliminated by setting the margin to screen width for typing (about 5.2 inches) and then changing it back to full-page width for final printout. This is sometimes a trick in itself, as I mentioned above, but fortunately there's a program available called *Toolkit* which makes global commands a reality for *geoWrite* documents.

From the *Toolkit* menu screen you can set the margins for an entire *geoWrite* document as well as change the font and style of all the text at once. You have to create a text scrap containing the desired ruler settings and/or font. This can be a little tricky at first, but once you get that down, you'll find *Toolkit* to be invaluable and easy to use. If you need to combine several *geoWrite* files into one longer document, you can use *Combiner*, a utility which very neatly does just that.

There's even an answer to the NLQ problems. A desk accessory called *Text Print* will print out a *geoWrite* document using the built-in NLQ font of your printer with all the italic, underlining, and boldface you could want. A companion program, *Custom Print*, must be used to customize a copy of *Text Print* to your printer's specific control codes.

One other feature which *geoWrite* lacks is a word counter. With *geoSpell* you find out at the very end how many words you have, but there's no way to find that information without first going through the entire spelling-checker process. There are several utilities available to provide a word count with the click of the mouse. In the January 1988 issue of *COM-*

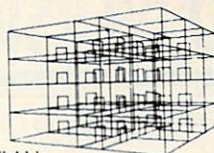
Even its fans find
geoWrite tough
to love, but here are
ways to make
it almost a pleasure
to use.

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PUTE!'s Gazette, there was a type-in program called *Word Count* by Shawn Smith which will fit the bill. Back issues and disks are still available from COMPUTE Publications at the Greensboro, North Carolina, office.

Several writing analyzers are available as public domain or shareware. *Blue Pencil*, one of the fine utilities from Student Software, will keep track of the number of words you've used of different lengths, as well as how many words you average per paragraph or sentence. Another, called *Copy Editor*, even makes a judgment as to the difficulty (grade level) of your prose. This helps you tailor your writing to your audience. Look for these on Q-Link or BBS Post, (616) 531-1346.

All this aside, there is something delightful about just watching all those great GEOS fonts trip across the screen in *geoWrite*. Let's face it, I think most people will agree that fonts are

one of the best things about GEOS. It takes a graphics-based, WYSIWYG word processor like *geoWrite* to do them justice. In turn, they can make your routine word processing into full-fledged desktop publishing!

In the last column I mentioned several printer drivers which do a good job of smoothing out the jagged images that plague printouts of bitmapped images. Susan Lamb, a graphic artist whose efforts with GEOS will be featured in next month's column, put me onto a great driver for those of you have 24-pin printers and, like me, are disappointed in the haphazard way GEOS supports them. It's called *EPSON24pin90dpi*. It's available on QuantumLink and on BBS Post. It creates a somewhat shortened printout in *geoPublish*, but the quality is astonishing. If you have an Epson-compatible 24-pin printer, this file is a must! □

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D'IVERSIONS

Fred D'Ignazio

LIVE, REALITY TELEVISION

I woke up this morning, wandered into the kitchen, and found a poppyseed muffin. After I had popped the muffin into the microwave, I clicked on the tea kettle and switched on the TV. Suddenly I was watching three astronauts floating live around the Atlantis space shuttle, going 20,000 miles per hour in zero gravity, hundreds of miles above the surface of the earth.

One male astronaut was stripped to the waist and wired up like a cardiac patient. He was reading a book and taking swigs of salt water from a plastic bottle. Another man floated around sideways, in shorts and white socks, eating a tortilla. And the third, a tired-looking female, was operating the shuttle's on-board camcorder that was taking these live TV pictures. The female astronaut was only inches in front of the camcorder lens. I felt as if she and her shuttle companions were with me in my kitchen. It seemed almost rude not to offer her a bite of my poppyseed muffin.

Welcome to live, reality TV!

More than 15 million Americans have camcorders, and more than 70 million have VCRs. TV cameras, VCRs, and TV screens showing electronic live and prerecorded images are everywhere: in department stores, in boutiques, inside bank teller machines, and hanging from tree branches on our state and federal roads and highways.

In Michigan, where I live, we motorists have become more cautious in recent weeks about our driving. That is because the state police have installed strings of video robocops in trees and bushes along several of the state's highways. Each high-tech ro-

bot policeman is composed of a video camera, computer, radio, and radar. When a speeding motorist zooms by, the hidden robot cameraman snaps a picture of the motorist's license plate, records the motorist's speed, and transmits the information to a central computer that mails the motorist a speeding ticket along with a snapshot that shows him whizzing by.

Several states are considering installing similar video-monitoring systems in people's homes to keep track of alcohol consumption by motorists who have been convicted of driving while intoxicated. The system is used during the period the person is on parole for his conviction. It is overseen by a central computer in a local police station.

The computer calls the person at random intervals via the local telephone system. The person walks up to the alcohol sensor and breathes into it, while the computer monitors the person's movements on a video camera. The computer instantly analyzes the person's movements and his or her breath. If alcohol is detected in the person's breath or his movements are especially erratic, the computer places a call to a police officer who races to the person's home and puts the offender under arrest.

Have you watched TV news lately? Have you noticed that the shots are filled with drama, real-life grit, glory, and gore? But they're also a tad jiggly, fuzzy, and abrupt, as if shot by a news cameraman who's got the heebie-jeebies.

The video footage you are watching has been shot by amateurs, like you and me. It's now an in thing even for network news programs and CNN to show amateur video on the air, especially if it captures a sensational news story as it's happening.

So you can forget videotaping birthday parties, family vacations, and holidays. Home movies are out; video news is in. Now you can become a combination sleuth, CIA agent, and high-tech snoop, all by keeping your eyes open and carrying your trusty video camera at your side. And you can make money, too.

Thousands of your friends and neighbors are doing likewise, and when they get video footage that seems hot, they bypass the local law enforcement officials and send it right to their local TV stations or even to New York, Washington, or Atlanta, to get it on national TV. Police watch TV more carefully these days. They know they might learn about a crime for the first time by seeing it on TV.

We are entering a video goldfish bowl. Camcorders are shrinking, getting more powerful zoom lenses, and dropping in price. Soon they'll be as ubiquitous as the Kodak Brownie or Instamatic. People will carry them wherever they go, aiming them at everything and everyone.

Life will be a video arena with everyone grabbing video slices of everyone else's life, in the hope that they can sell them for a few dollars to the evening news or programs patterned after the phenomenally successful "America's Funniest Home Videos."

You'd better watch out. The next time you slip down the porch stairs in front of your home or yell at your kids or drive above the speed limit, someone might capture that act on videotape and send you a ticket. Or maybe you'll see yourself on the evening news or a national comedy show. Your misfortunes could gladden the hearts of millions of viewers. It may feel like video martyrdom to you, but it's just live, reality TV! □

**Smile,
America! Home
movies are
out; video news
is in.**

BEGINNER BASIC

Larry Cotton

MY FAVORITE BASIC KEYWORD

I don't ordinarily go around unabashedly touting a particular BASIC keyword, but RND is one I get excited about.

RND creates unpredictable havoc out of order—that's why I like it! Let's see if you can share some of my enthusiasm for this very useful function.

RND creates a virtually random number for use in games, music, graphics, and so forth. However, to generate the first random number, the function depends on a nonrandom seed, or starting number, that is automatically loaded into certain memory registers when the 64 is turned on.

To make the seed as random as possible, use the computer's internal clock (TI) as the argument and convert it to a negative value. The argument is a number inside the parentheses following RND. The best way to see RND in action is by example.

```
10 X=RND(-TI)
20 FORT=1T05:PRINTRND(1):
NEXT
```

After you run it, you should see five nonrepeating numbers between 0 and 1. Any positive number can be substituted for the 1, with similar results. Now enter and run this:

```
10 X=RND(-TI)
20 FORT=1T05:PRINT2*RND
(1):NEXT
```

You will now see five numbers between 0 and 2. We can truncate these numbers by adding the INT function.

```
10 X=RND(-TI)
20 FORT=1T05:PRINTINT(2*
RND(1)):NEXT
```

Be sure to use two opening and two closing parentheses.

How about random choices of two things, such as Yes and No for a Ouija board? Here's a way to do just that, using BASIC's ON and GOTO.

```
10 X=RND(-TI)
20 X=INT(2*RND(1))
30 ONX+1GOTO100,110
100 PRINT"YES":END
110 PRINT"NO":END
```

Run this program a few times and observe the results. Recall that ON and GOTO can control the flow of a BASIC program, so if X=0, then X+1=1, and control goes to line 100. If X=1, then X+1=2, and control jumps to line 110. To add a third alternative:

```
10 X=RND(-TI)
20 X=INT(3*RND(1))
30 ONX+1GOTO100,110,120
100 PRINT"YES":END
110 PRINT"NO":END
120 PRINT"MAYBE":END
```

To increase the range, change 3 to another number.

Again, using ON and GOTO, you can create a higher percentage of a particular response, thereby tilting the odds one way or another.

```
10 X=RND(-TI)
20 PRINTCHR$(147):POKE214,
10:PRINT
30 X=INT(5*RND(1))+1
40 ONXGOTO50,50,50,60,60
50 PRINT"ODD":GOTO70
60 PRINT"EVEN"
70 GETA$:IFA$=""THEN70
80 GOTO20
```

Run this program; then touch any key to run it again. In line 30 we add 1 to the randomly generated number to yield numbers from 1 to 5, inclusive. If X is 1, 2, or 3, then line 50 will be the target GOTO line. If X is 4 or 5, line 60 will be chosen. The computer will seem randomly to choose between odd and even yet will pick, on aver-

age, three odds for every two evens. Shades of Las Vegas!

Speaking of Las Vegas, here's a short program to simulate rolling one die:

```
10 X=RND(-TI)
20 PRINTCHR$(147)
30 X=INT(6*RND(1))+1
40 PRINTX
50 GETA$:IFA$=""THEN50
60 GOTO30
```

A random number from 1 to 6 will be generated. Press any key to see another, or hold a key down to see a string of rolls. Now, what else can be done with this function?

RND can also produce interesting, if not beautiful, music. Enter this short program:

```
10 X=RND(-TI)
20 FORT=54272T054295:
POKET,0:NEXT
30 POKE54296,15
40 POKE54278,255
50 POKE54276,33
60 FORT=1T0500:NEXT
70 POKE54273,INT(100*RND
(1))+10
80 FORT=1T0100:NEXT
90 GOTO70
```

Line 20 clears the sound chip, line 30 turns up the volume, and line 40 sets sustain and release to maximum (attack and decay default to 0). Line 50 turns on the sawtooth waveform, and line 60 creates a short pause.

Line 70 pokes a random frequency from 10 through 100 into voice 1's main frequency register. Line 80 allows the selected tone to sound a moment; then line 90 returns control to line 70, which generates another (probably different) random frequency and pokes it to the frequency register again. Press the Run/Stop key to halt the program.

Now experiment. Change lines 60 and 70 so that tone lengths and pitches, respectively, are also random. □

RND seemingly sets the precise world of computing awry, creating unpredictable havoc out of order.

PROGRAMMER'S PAGE

Randy Thompson

HOW OLD ROMS THWART FLOODS

An empty screen is all I saw when I first ran *Flood*, the game with the surprisingly short listing located at the end of this page. After 20 seconds of blank blue, however, I decided something was wrong with this submission.

Trusting that author Geza Lucz of La Jolla, California, wouldn't send me a game with no visible graphics, I hit Run/Stop and typed LIST to diagnose the problem. It turns out the problem was simple, and one I've dealt with before.

You see, I have a very old 64. I bought this machine back when a blank bright blue computer-generated screen seemed impressive. Anyway, if you own one of these elderly computers, then you know that the ROMs housed within it handle screen color memory differently from 128s and late model 64s.

By default, color memory on an old 64 is set to the text's background color instead of its foreground color. This means that if you poke a character into screen memory, it won't appear unless you also poke a nonbackground color into the corresponding color memory location. So all the characters that *Flood* was laboriously poking across my screen might as well have been spaces, since they adopted the same color as the rest of the screen.

The most obvious solution to this problem is to add a POKE to color memory for every POKE to screen memory. This would slow down the game, however. A better solution is to do as the new 64 ROMs do—preset all of color memory to the foreground color so that any POKE to screen memory produces visible re-

sults. This can be achieved with the loop FOR I=55296 TO 56295: POKE I, color: NEXT strategically placed at the beginning of the program.

But there's an even easier way—one that takes advantage of the way old 64s fill screen memory with the current background color whenever the screen is cleared. Take a look at this.

**POKE 53281,14:PRINT
CHR\$(147):POKE 53281,6**

The first POKE sets the screen's background color to the color that we want our game's characters to appear in. Next, the PRINT CHR\$(147) clears the screen, forcing the computer to fill color memory with the current background color (which, unbeknownst to the computer, is actually our desired foreground color). Finally, the last POKE sets the screen's background color back to normal. Now a POKE to screen memory results in a visible character, no matter how young or how old your 64. You can see this code added to line 100 of the *Flood* program described below.

With the game graphics working, I found *Flood* to be quite entertaining. It's also a good example of what you can do with standard Commodore characters and direct access to screen memory.

The object of the game is to contain a spreading body of water (represented by a growing group of asterisks) by building flood walls. Your score is determined by how quickly and effectively you accomplish this task.

Your onscreen persona appears as a square checkerboard that moves about the screen via the cursor keys. To build a flood wall where you stand, hit Return. Be careful that you don't wall yourself in,

since nothing—not even your stylish square body—can scale the sturdy walls. So have fun and good luck.

As flood waters threaten to engulf you, this short program for the 64 is your only hope for survival.

Send your programming tips and tricks to Programmer's Page, COMPUTE's Gazette, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. We pay \$25-\$50 for each tip we use. □

RAMDRIVE 64

By Hong Pham

How would you like to have another disk drive that lets you access programs and files almost instantly? That's what you get with *Ramdrive 64*.

This program adds a virtual RAM drive to your 64. With information stored in memory, it doesn't have to access a mechanical disk drive. Programs load and save extremely fast. A 70-block program can load in less than four seconds.

What's more, *Ramdrive* does not use any BASIC memory. Instead, it uses the RAM under BASIC and Kernal ROM (\$A000-\$BFFF and \$D000-\$FFFF) to store files. That's about 80 blocks: 77 blocks to store data and 3 for the block availability map and directory.

Getting Started

Ramdrive is written entirely in machine language. To enter the program, use *MLX*, our machine language entry program. When *MLX* prompts you, respond with the following values.

Starting address: 7D00

Ending address: 86CF

When you have finished typing in *Ramdrive*, be sure to save it to a work disk under the name RAMDRIVE.OBJ because *Relocator*, a companion program mentioned below, searches for that name. To use *Ramdrive*, load it with LOAD "RAMDRIVE.OBJ",8,1 and then type SYS 32000, or whatever address you may have relocated it to.

Different Device

Ramdrive acts like any other storage device, such as a 1541 disk drive. That means you can load and save to it as if you were using an external disk drive. Like any device, *Ramdrive* has its own device number. The default device number is 7.

To save to the RAM drive, use the standard SAVE command. For example, SAVE "filename",7 with *filename* being the name of your file. A maximum of 77 blocks or a total of 30 files can be saved to the RAM drive. To load from the RAM drive, use LOAD "filename",7. Wildcard scans are allowed in a load operation. An asterisk (*) will

either load the first file on the directory or the first file with the matching character pattern preceding the asterisk. A question mark (?) can be used to replace an unknown character. Remember that information saved to a RAM drive is not permanent. It's lost once the computer is turned off. So be sure to save any alterations you may have made and want to keep to a disk before you turn off your computer.

RAM Drive Commands

Any device without a good BASIC interface would be clumsy and awkward to use. *Ramdrive 64* adds eight new BASIC commands to make accessing data and programs easier.

BLOAD "filename", device number, starting address

Load a binary file from a device and put it at a specified location in memory. Unlike the standard LOAD command, BLOAD does not corrupt BASIC pointers and reruns any BASIC program already in memory.

BSAVE "filename", device number, starting address, ending address

Save a binary file to a device from a specified memory location.

RDIR

Display the RAM drive directory with RDIR. Unlike in the disk directory display, the file length and the free RAM space are displayed in bytes. LOAD "\$",7 has the same effect as RDIR.

ERASE "filename"

Use this command to erase a file from the RAM drive. As with the LOAD command, wildcard scans are allowed in ERASE. To erase all the files in the directory, use ERASE "*".

DEVICE 0-255

Change the RAM drive device number with this command. Any number between 0 and 255 can be used, but the default RAM drive device number is 7. If you forget what number you assign to the device, enter DEVICE without an

argument, and *Ramdrive* will display the current RAM drive device number.

INIT

This command will initialize the RAM drive. Unlike ERASE "*", INIT clears everything: both the block availability map and the directory. On activation, *Ramdrive* initializes itself. If you accidentally disable the program and don't want to initialize the RAM drive itself, use SYS 32003 or SYS whatever address you choose, and add 3 to it.

VALIDATE

Validate the RAM drive. Although *Ramdrive* validates after every unsuccessful SAVE, use VALIDATE to fix the directory if you have problems.

DISABLE

Use this command to disable *Ramdrive*. SYS 65418 normally restores vectors, but it will not disable *Ramdrive*, nor will Run/Stop-Restore because the load and save vectors are fixed whenever a BASIC command is used. The previous load, save, and BASIC system vectors are restored when *Ramdrive* is disabled.

Although these next two features were originally debugging tools, I thought them too good to leave out. To warm reset the system, hit the space bar and Restore key simultaneously. The Run/Stop key is disabled. To reset the system to the power-up state, press the Back Arrow and Restore keys simultaneously. This routine is a handy debugging tool if you don't have a reset switch and your computer is too corrupt to warm start.

Relocate

Because there is no definite safe memory location in the 64, a conflict for the same memory could result between *Ramdrive* and another program. Where *Ramdrive* is situated, it is safe from programs such as *Metabasic*, *Bassem*, and *Micromon*, but lengthy BASIC programs or strings could overwrite *Ramdrive*.

Relocator solves this potential problem by relocating *Ramdrive* to another location anywhere in memory. Once

PROGRAMS

again, enter this program with *MLX* with the following prompts and be sure to save a copy.

Starting address: 0801

Ending address: 0FB8

Relocator loads and runs like a BASIC program. Once the file has been loaded, type RUN. When *Relocator* prompts for the new starting address for *Ramdrive*, enter the address in hexadecimal. If you don't have a good scientific calculator handy to convert decimal to hexadecimal, the following program may help.

```
PE 10 H$ = "0123456789ABCDEF": B = 16:
B1 = 218
FP 20 INPUT "ENTER DECIMAL VALUE":N: IF
ABS(N)>B1-1 THEN 20
PP 30 N$ = "": IFN<0 THEN N = B1+N
FF 40 FOR I = 1 TO B/4:T = N-(INT(N/16)*16):
N$ = MID$(H$,T+1,1)+N$:N = N/16
CG 50 NEXT: PRINTN$
```

After *Relocator* relocates *Ramdrive*, insert a work disk to save the relocated version of *Ramdrive*. If the save is successful, you may exit to BASIC or relocate another copy of *Ramdrive*. Be sure to remember your new starting address and to add 3 to it when you want to run it.

RAMDRIVE 64

```
7D00:20 F5 81 20 AE 84 20 DF 62
7D08:84 A9 81 A2 7D 8D FA FF 22
7D10:8E FB FF 20 44 E5 20 6B B8
7D18:84 A2 08 20 62 84 A9 A6 20
7D20:A0 85 20 1E AB A9 BF A0 D6
7D28:85 20 1E AB A2 06 20 62 3C
7D30:84 4C 34 85 48 8A 48 98 F4
7D38:48 AD 01 DC C9 EF F0 09 A9
7D40:C9 FD F0 1D 20 ED F6 D0 07
7D48:15 20 12 85 20 81 FF 20 97
7D50:8A FF 20 F3 84 20 84 FF 81
7D58:EA EA EA 02 A0 4C 9F 72
7D60:7D A2 FF 78 9A D8 E8 8A DE
7D68:95 02 E8 D0 FB 20 A3 FD 7E
7D70:A2 00 A0 A0 20 8C FD 20 2A
7D78:15 20 D0 5B FF 58 6C 00 71
7D80:A0 48 8E 95 7D 20 EF 81 D6
7D88:78 A9 99 A2 7D 8D 5F 7D E5
7D90:8E 60 7D 68 A2 FF 4C 34 03
7D98:7D 20 12 85 20 E4 81 68 F4
7DA0:A8 68 AA 68 40 20 73 00 4F
7DA8:20 D4 E1 A6 2D A4 2E A9 91
7DB0:2B 20 D8 FF B0 03 4C 3B C9
7DB8:7E 08 48 AD 46 85 C5 BA 67
7DC0:F0 05 68 28 4C F9 E0 68 79
7DC8:28 6C 00 03 A5 7A A6 7B 03
7DD0:8D 62 85 8E 63 85 A9 00 49
```

```
7DD8:8D 61 85 20 F3 84 A9 64 0F
7DE0:A2 85 85 29 86 2A 20 73 62
7DE8:00 C9 94 F0 B8 20 1D 85 FD
7DF0:A0 00 B1 29 F0 29 20 73 E4
7DF8:00 D1 29 D0 03 C8 D0 F2 6A
7E00:20 1D 85 EE 61 85 EE 61 54
7E08:85 AD 61 85 C9 12 B0 25 D4
7E10:A0 00 20 97 82 B1 29 D0 D8
7E18:F9 20 97 82 4C ED 7D 20 6A
7E20:73 00 AE 61 85 BD 94 85 94
7E28:8D 33 7E E8 BD 94 85 8D EF
7E30:34 7E 4C FF FF 20 1D 85 B0
7E38:4C 3D 7E C6 7A 4C FF FF EB
7E40:20 57 E2 20 BD FF 20 F1 A1
7E48:B7 A9 0F A0 00 20 BA FF 6D
7E50:20 28 85 A4 C3 85 C4 A9 C7
7E58:00 20 A2 F4 08 A5 BA CD 1B
7E60:46 85 F0 04 28 4C 3B 7E A7
7E68:28 B0 02 90 CE 6C 00 03 1A
7E70:20 57 E2 20 BD FF AE 46 43
7E78:85 20 F1 B7 A9 0F A0 08 CC
7E80:20 BA FF 20 28 85 84 C1 60
7E88:85 C2 20 28 85 84 AE 85 A0
7E90:AF 20 EA F5 4C 5C 7E 20 1B
7E98:10 83 4C 3B 7E 20 F5 81 9D
7EA0:A9 66 A0 86 20 1E AB 4C A5
7EA8:3B 7E 20 57 E2 86 22 84 56
7EB0:23 A8 D0 05 A2 08 6C 00 E1
7EB8:03 98 A6 22 A4 23 20 BD 04
7EC0:FF AD 46 85 85 BA 20 BA 5C
7EC8:FF 20 70 84 4C 3B 7E 20 90
7ED0:E4 81 20 D2 82 20 EF 81 C7
7ED8:4C 3B 7E 20 79 00 F0 0A 54
7EE0:C9 3A F0 06 20 F4 B7 8E A2
7EE8:46 85 20 31 85 4C 3B 7E D3
7EF0:A9 47 A2 FE 8D 18 03 8E 3A
7EF8:19 03 AD 7A 7F AE 7B 7F CD
7F00:8D 30 03 8E 31 03 AD 48 54
7F08:80 AE 49 80 8D 32 03 8E ED
7F10:33 03 AD 3E 7E AE 3F 7E AE
7F18:8D 08 03 8E 09 03 AD 46 1F
7F20:7F AE 47 7F 8D 00 03 8E 6C
7F28:01 03 A9 7E A0 86 20 1E 03
7F30:AB 4C 3B 7E 38 E0 41 F0 20
7F38:0F E0 42 F0 11 E0 43 F0 D1
7F40:13 E0 44 F0 15 4C FF FF 72
7F48:A9 93 A0 86 B0 10 A9 9F 36
7F50:A0 86 B0 0A A9 AE A0 86 C7
7F58:B0 04 A9 BC A0 86 48 20 81
7F60:6B 84 A9 3F 20 D2 FF 68 14
7F68:20 1E AB 4C 65 A4 85 93 95
7F70:A5 BA CD 46 85 F0 05 A5 AE
7F78:93 4C FF FF A5 93 D0 F7 69
7F80:20 AF F5 A5 B7 10 04 38 D2
7F88:A2 08 60 A0 00 B1 BB C9 F8
7F90:24 D0 09 20 D2 F5 20 6B 13
7F98:84 4C 10 83 20 E4 81 20 DE
7FA0:3B 82 20 EF 81 90 03 A2 D7
7FA8:04 60 20 D2 F5 20 E4 81 6E
7FB0:20 3B 82 8D C7 82 A9 00 53
7FB8:85 90 8D C6 82 AA 20 C5 81
7FC0:82 8D F0 7F E8 A8 D0 07 0D
7FC8:20 C5 82 8D 05 80 E8 A5 14
7FD0:B9 F0 11 20 C5 82 8D 47 A7
7FD8:85 E8 20 C5 82 98 AE 47 50
7FE0:85 4C E8 7F A6 C3 A4 C4 1D
7FE8:86 29 84 2A A2 03 A8 A9 C4
7FF0:FF D0 1F E8 8E C6 82 AA D5
7FF8:EE 05 80 20 C5 82 91 29 47
8000:2E 97 82 E8 E0 FF 90 F3 F1
```

```
8008:20 EF 81 18 98 A6 29 A4 1D
8010:2A 60 8D 21 80 20 C5 82 94
8018:91 29 20 97 82 E8 D0 F5 F8
8020:A9 FF 8D C7 82 8E C6 82 82
8028:20 C5 82 F0 06 8D 21 80 33
8030:E8 D0 E2 E8 20 C5 82 8D 6F
8038:05 80 EE 05 80 E8 D0 BB 0F
8040:A5 BA CD 46 85 F0 03 4C 23
8048:FF FF 20 8F F6 A5 B7 D0 D4
8050:04 38 A2 08 60 20 E4 81 05
8058:20 3B 82 B0 05 A2 41 4C 15
8060:A5 82 20 C9 82 A0 11 A2 D0
8068:00 B1 27 F0 0F 30 0D 20 3D
8070:80 82 E8 E0 1E D0 F2 A2 3A
8078:42 4C A5 82 A0 00 B1 BB AE
8080:C9 2A F0 08 C9 A0 F0 04 46
8088:C9 3F D0 05 A2 44 4C A5 0D
8090:82 91 27 C8 C4 B7 90 E6 B5
8098:A9 A0 C0 10 B0 05 91 27 93
80A0:C8 D0 F7 20 8C 82 90 03 CD
80A8:4C A3 82 48 A9 01 9D 50 6A
80B0:FD 68 8D 60 85 A0 10 91 E2
80B8:27 C8 A9 80 91 27 A5 AE DF
80C0:E5 C1 8D 5E 85 A0 12 91 21
80C8:27 A5 AF E5 C2 8D F5 85 AB
80D0:A0 13 91 27 AD 60 85 85 0B
80D8:2A A0 00 84 29 AD 5F 85 A3
80E0:D0 3F AD 5E 85 C9 FC B0 B3
80E8:38 A9 00 91 29 20 97 82 05
80F0:AD 5E 85 91 29 20 97 82 A5
80F8:A5 C1 91 29 20 97 82 A5 0C
8100:C2 91 29 20 97 82 AE 5E 72
8108:85 E8 B1 C1 91 29 C8 CA E7
8110:D0 F8 A0 11 A9 01 91 27 7A
8118:18 20 EF 81 A6 AE A4 AF 2E
8120:60 A5 C1 A6 C2 8D B4 82 97
8128:8E B5 82 20 8C 82 90 03 C4
8130:4C A3 82 A0 00 91 29 20 55
8138:97 82 A5 C1 91 29 20 97 81
8140:82 A5 C2 91 29 20 97 82 DA
8148:20 B3 82 91 29 C8 C0 FD 9D
8150:D0 F6 20 B7 82 20 8C 82 29
8158:85 2A A0 00 84 29 A9 01 D9
8160:9D 50 FD 38 AD 5E 85 E9 65
8168:FD 8D 5E 85 AD 5F 85 E9 D1
8170:F0 8D 5F 85 AD 5F 85 D0 E1
8178:2F AD 5E 85 C9 FE B0 28 76
8180:A9 00 91 29 20 97 82 AE 30
8188:5E 85 E8 E8 8A 91 29 20 D4
8190:97 82 EE 5E 85 A2 00 20 9A
8198:B3 82 91 29 C8 CC 5E 85 96
81A0:D0 F5 20 B7 82 4C 12 81 F3
81A8:20 8C 82 90 03 4C A3 82 4B
81B0:91 29 20 97 82 20 B3 82 C2
81B8:91 29 C8 C0 FF D0 F6 20 45
81C0:B7 82 20 8C 82 85 2A A0 2C
81C8:00 84 29 A9 01 9D 50 FD C9
81D0:38 AD 5E 85 E9 FF 8D 5E 48
81D8:85 AD 5F 85 E9 00 8D 5F 18
81E0:85 4C 74 81 78 A5 01 8D 4A
81E8:F0 81 A9 F4 85 01 60 A9 E3
81F0:37 85 01 58 60 A2 00 8A AE
81F8:9D A0 FD 9D 00 FE 9D F2 B6
8200:FE E8 D0 F4 A2 00 8A 9D EF
8208:50 FD E8 E0 4F D0 F8 60 EF
8210:C9 A0 90 18 C9 C0 B0 06 6E
8218:38 E9 A0 AA 18 60 C9 D0 19
8220:90 0A C9 FD B0 06 38 E9 01
8228:B0 4C 1B 82 38 60 18 E0 78
8230:20 B0 04 8A 69 A0 60 8A B3
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8238:69 AF 60 20 C9 82 A2 00 89
8240:A0 00 B1 BB C9 2A F0 24 84
8248:C9 3F F0 04 D1 27 D0 0F 3C
8250:C8 C4 B7 90 ED C0 10 F0 6E
8258:13 B1 27 C9 A0 F0 0D E8 A0
8260:E0 1F F0 06 20 80 82 4C 70
8268:40 82 38 60 A0 11 B1 27 0F
8270:F0 ED 30 EB 18 88 B1 27 9B
8278:48 A0 12 B1 27 A8 68 60 34
8280:18 A5 27 69 14 85 27 90 0C
8288:02 E6 28 6A A2 4C BD 50 65
8290:FD F0 0B CA 10 F8 38 E6 9A
8298:29 D0 02 E6 2A 60 20 2E 56
82A0:82 18 60 A2 43 8E 48 85 8D
82A8:20 D2 82 AE 48 85 38 20 96
82B0:EF 81 60 B9 FF FF 60 18 8E
82B8:98 6D B4 82 8D B4 82 90 F8
82C0:03 EE B5 82 60 BD FF FF DB
82C8:60 A9 A0 A2 FD 85 27 86 81
82D0:28 60 20 C9 82 20 04 82 C1
82D8:A2 00 8E 47 85 A0 11 B1 F7
82E0:27 F0 22 30 20 88 B1 27 AA
82E8:8D FC 82 48 A9 00 8D FB 2D
82F0:82 68 20 10 82 A9 01 9D B0
82F8:50 FD AD FF FF 8D FC 82 0E
8300:F0 03 4C F2 82 EE 47 85 DC
8308:AD 47 85 C9 1E D0 CE 60 37
8310:20 6B 84 A2 03 20 62 84 9E
8318:A9 04 A0 86 20 1E AB 20 62
8320:6B 84 A9 12 20 D2 FF A2 43
8328:04 20 62 84 A9 43 A0 86 EF
8330:20 1E AB A2 09 20 62 84 80
8338:A9 4C A0 86 20 1E AB A2 17
8340:04 20 62 84 20 6B 84 20 BD
8348:E4 81 20 C9 82 A9 00 8D B0
8350:48 85 8D 61 85 A0 00 B1 05
8358:27 99 49 85 C8 C0 14 D0 1D
8360:F6 A0 11 B9 49 85 F0 35 40
8368:30 33 20 EF 81 EE 61 85 67
8370:A2 00 BD 49 85 20 D2 FF 67
8378:E8 E0 10 D0 F5 A9 20 20 F1
8380:D2 FF AD 5B 85 AE 5C 85 81
8388:20 FA 83 A9 1C A0 86 20 F9
8390:1E AB 20 6B 84 20 E1 FF B4
8398:F0 13 20 E4 81 20 80 82 3F
83A0:EE 48 85 AD 48 85 C9 1E C6
83A8:F0 03 4C 55 83 20 EF 81 C5
83B0:20 6B 84 A9 20 20 D2 FF F4
83B8:AE 61 85 A9 00 20 CD BD 94
83C0:A9 2B A0 86 20 1E AB 20 D4
83C8:E4 81 A9 00 8D 61 85 A2 77
83D0:4C BD 50 FD D0 03 EE 61 29
83D8:85 CA 10 F5 20 EF 81 A9 24
83E0:20 20 D2 FF AD 61 85 A2 FA
83E8:00 20 CD BD A9 1C A0 86 13
83F0:20 1E AB A9 23 A0 86 4C 94
83F8:1E AB 8D 57 85 8E 58 85 BD
8400:A9 00 8D 59 85 8D 5A 85 C1
8408:8D 5B 85 8D 5C 85 A2 0F 85
8410:0E 57 85 2E 58 85 78 F8 4C
8418:AD 59 85 6D 59 85 8D 59 2B
8420:85 AD 5A 85 6D 5A 85 8D 68
8428:5A 85 AD 5B 85 6D 5B 85 49
8430:8D 5B 85 8D 58 CA 10 D8 FB
8438:A2 02 BD 59 85 48 4A 4A 8C
8440:4A 4A 20 4F 84 68 29 0F 21
8448:20 4F 84 CA 10 EC 60 CD 35
8450:5C 85 D0 04 A9 20 D0 07 B9
8458:09 30 A0 FF 8C 5C 85 4C 33
8460:D2 FF A9 20 20 D2 FF CA 21

```

```

8468:D0 FA 60 A9 0D 4C D2 FF 7E
8470:20 E4 81 A9 00 8D 47 85 D7
8478:8D 48 85 20 3B 82 B0 09 5B
8480:A0 11 A9 00 91 27 EE 48 A2
8488:85 20 80 82 EE 47 85 AD E1
8490:47 85 C9 1E D0 E5 20 D2 EA
8498:82 20 EF 81 20 6B 84 A9 62
84A0:00 AE 48 85 20 CD BD A9 14
84A8:51 A0 86 4C 1E AB AD 30 43
84B0:03 AE 31 03 8D 7A 7F 8E 21
84B8:7B 7F AD 32 03 AE 33 03 74
84C0:8D 48 80 8E 49 80 AD 08 4B
84C8:03 AE 09 03 8D 3E 7E 8E 41
84D0:3F 7E AD 00 03 AE 01 03 A6
84D8:8D 46 7F 8E 47 7F 60 A9 B5
84E0:CC A2 7D 8D 08 03 8E 09 F3
84E8:03 A9 34 A2 7F 8D 00 03 C3
84F0:8E 01 03 A9 34 A2 7D 8D 31
84F8:18 03 8E 19 03 A9 6E A2 70
8500:7F 8D 30 03 8E 31 03 A9 4D
8508:40 A2 80 8D 32 03 8E 33 B2
8510:03 60 A9 9F A2 7D 8D 5F 69
8518:7D 8E 60 7D 60 AD 62 85 6D
8520:85 7A AD 63 85 85 7B 60 12
8528:20 0E E2 20 8A AD 4C F7 C0
8530:B7 20 6B 84 A9 E9 A0 85 90
8538:20 1E AB A9 00 AE 46 85 B7
8540:20 CD BD 4C 6B 84 07 00 C6
8548:00 00 00 00 00 00 00 00 5B
8550:00 00 00 00 00 00 00 00 63
8558:00 00 00 00 00 00 00 00 42
8560:00 00 00 00 00 00 00 00 52
8568:94 00 52 44 49 52 00 52 32
8570:D6 00 49 4E 49 54 00 45 D5
8578:52 41 53 45 00 C5 49 44 A9
8580:41 54 45 00 44 49 53 41 19
8588:42 4C 45 00 44 45 56 49 9D
8590:43 45 00 00 40 7E 70 7E E9
8598:97 7E 97 7E 9D 7E AA 7E A4
85A0:CF 7E F0 7E DB 7E 43 36 CE
85A8:34 20 52 41 4D 2D 44 52 2E
85B0:49 56 45 20 49 4E 53 54 1F
85B8:41 4C 4C 45 44 0D 00 0D B8
85C0:20 20 43 4F 50 59 52 49 17
85C8:47 48 54 20 31 39 39 31 28
85D0:20 42 59 20 48 4F 4E 47 0D
85D8:20 50 48 41 4D 20 2F 56 C4
85E0:39 31 30 37 31 32 0D 0D C7
85E8:00 52 41 4D 44 52 49 56 D9
85F0:45 20 44 45 56 49 43 45 27
85F8:20 4E 55 4D 42 45 52 20 13
8600:49 53 20 00 43 36 34 20 06
8608:52 41 4D 44 52 49 56 45 26
8610:20 44 49 52 45 43 54 4F BB
8618:52 59 0D 00 20 42 59 54 57
8620:45 53 00 20 46 52 45 45 F1
8628:2E 0D 00 20 46 49 4C 45 C6
8630:28 53 29 20 49 4E 20 44 55
8638:49 52 45 43 54 4F 52 59 39
8640:2E 0D 00 46 49 4C 45 4E 60
8648:41 4D 45 00 53 49 5A 45 AB
8650:00 20 46 49 4C 45 53 28 09
8658:53 29 20 53 43 52 41 54 CC
8660:43 48 45 44 2E 00 0D 52 EB
8668:41 4D 44 52 49 56 45 20 65
8670:49 4E 49 54 49 41 4C 49 55
8678:5A 45 44 2E 0D 00 52 44
8680:41 4D 44 52 49 56 45 20 7D
8688:44 49 53 41 42 4C 45 44 9A
8690:2E 0D 00 46 49 4C 45 20 82

```

```

8698:45 58 49 53 54 53 00 44 F0
86A0:49 52 45 43 54 4F 52 59 A1
86A8:20 46 55 4C 4C 00 52 41 0F
86B0:4D 44 52 49 56 45 20 46 A2
86B8:55 4C 4C 00 49 4C 4C 45 66
86C0:47 41 4C 20 46 49 4C 45 82
86C8:4E 41 4D 45 00 00 00 00 4B

```

RELOCATOR

```

0801:0E 08 C7 07 9E 20 28 32 7B
0809:30 36 34 29 00 00 00 78 50
0811:A2 FF 9A 20 A3 FD 20 15 32
0819:FD 20 5B FF 58 A9 05 20 2F
0821:D2 FF A9 93 20 D2 FF A9 FE
0829:00 20 90 FF A9 06 8D 20 F3
0831:D0 8D 21 D0 A2 02 A0 0A A6
0839:18 20 F0 FF A9 0F 8D 86 A6
0841:02 A9 AF 20 0D 0D A2 8A 21
0849:A0 0E 20 20 0D 20 15 0D 53
0851:A9 0B 8D 86 02 A9 B7 20 59
0859:0D 0D 18 A0 02 A2 06 20 07
0861:F0 FF A2 A4 A0 0E 20 20 26
0869:0D 18 A0 00 A2 09 20 F0 84
0871:FF AD 69 0E F0 03 4C DF 07
0879:08 A2 C9 A0 0E 20 20 0D B7
0881:A0 04 A2 0A 18 20 F0 FF FA
0889:A2 F3 A0 0E 20 20 0D 20 98
0891:34 0D 20 34 0D 20 E4 FF F8
0899:F0 FB A2 13 A0 0F 20 20 48
08A1:0D A9 05 A6 BA A0 FF 20 26
08A9:BA FF A9 10 A2 6A A0 0E 5B
08B1:20 BD FF A9 00 20 D5 FF 08
08B9:20 B7 FF 29 0F F0 1F A2 77
08C1:21 A0 0F 20 20 0D A2 39 22
08C9:A0 0F 20 20 0D 20 E4 FF A6
08D1:C9 59 F0 07 C9 4E 0D F5 CA
08D9:6C FC FF 4C 10 08 A9 01 19
08E1:8D 69 0E A2 4A A0 0F 20 12
08E9:20 0D A9 00 8D A2 0D 85 19
08F1:CC A9 01 8D 86 02 20 E4 2D
08F9:FF F0 FB C9 0D F0 21 C9 9A
0901:14 F0 0D A2 0F DD 7A 0E 18
0909:F0 20 CA 10 F8 4C F7 08 E6
0911:AD A2 0D F0 E1 A9 14 20 51
0919:D2 FF CE A2 0D 4C F7 08 2A
0921:AD A2 0D C9 04 90 CF 4C 3F
0929:4C 09 AE A2 0D 9D A3 0D D6
0931:20 D2 FF EE A2 0D AD A2 3E
0939:0D C9 04 D0 B9 20 E4 FF E9
0941:C9 14 F0 CC C9 0D F0 D8 65
0949:4C 3E 09 A9 01 85 CC A9 2E
0951:20 20 D2 FF AE A3 0D AC A0
0959:4A 0D 20 39 0D 8D 99 0D 77
0961:AE A5 0D AC A6 0D 20 39 83
0969:0D 8D 98 0D 20 34 0D A2 D7
0971:61 A0 0F 20 20 0D 20 97 4D
0979:0A A2 71 A0 0F 20 20 0D B7
0981:A9 00 85 CC 8D A2 0D 20 17
0989:E4 FF C9 0D F0 26 C9 14 DF
0991:F0 2A C9 20 0F F1 C9 80 42
0999:B0 03 4C A2 09 C9 A0 90 B9
09A1:E6 AE A2 0D 0E 10 F0 DF 01
09A9:20 D2 FF 9D A3 0F EE A2 34
09B1:0D 4C 88 09 AD A2 0D F0 02
09B9:CE 4C D2 09 AE A2 0D F0 3C
09C1:C6 A9 14 20 D2 FF A9 00 10
09C9:9D A3 0F CE A2 0D 4C 88 CC

```


PROGRAMS

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09D1:09 A9 01 85 CC A9 20 20 B8
09D9:D2 FF 20 34 0D A2 85 A0 3B
09E1:0F 20 20 0D AE A2 0D A0 13
09E9:00 B9 9F 0F 9D A3 0F EE D7
09F1:A2 0D E8 C8 C0 04 D0 F1 EB
09F9:18 AD 9A 0D 6D 9E 0D 8D 35
0A01:A9 0D AD 9B 0D 6D 9F 0D 07
0A09:8D AA 0D AD 9E 0D AE 9F 31
0A11:0D 85 FD 86 FE AD A2 0D 36
0A19:A2 A3 A0 0F 20 BD FF A9 0E
0A21:05 A6 BA A0 05 20 BA FF E0
0A29:20 C0 FF 20 B7 FF 29 0F 9E
0A31:F0 03 4C 6C 0D A2 05 20 EB
0A39:C9 FF AD 98 0D 20 D2 FF FF
0A41:AD 99 0D 20 D2 FF A0 00 0E
0A49:B1 FD 20 D2 FF 20 B7 FF D6
0A51:29 0F F0 03 4C 6C 0D E6 21
0A59:FD D0 02 E6 FE 38 AD A9 2D
0A61:0D E5 FD 8D A8 0D AD AA 8D
0A69:0D E5 FE 0D A8 0D B0 D8 E1
0A71:A9 05 20 C3 FF 20 CC FF F5
0A79:20 34 0D 20 34 0D A2 91 FA
0A81:A0 0F 20 20 0D 20 E4 FF 62
0A89:C9 59 D0 03 4C 10 08 C9 9F
0A91:4E D0 F2 6C FC FF 20 8E DC
0A99:0C AD 9E 0D AE 9F 0D 8D 5F
0AA1:BC 0A 8E BD 0A AD 96 0D 85
0AA9:AE 97 0D 8D B9 0A 8E BA 43
0AB1:0A A2 00 AC 9B 0D C8 BD 9E
0AB9:FF FF 9D FE FF E8 D0 F7 AE
0AC1:EE BA 0A EE BD 0A 88 D0 24
0AC9:EE 20 D3 0A 20 08 0C AC FD
0AD1:2C 0C 18 AD 96 0D 6D 9C 3D
0AD9:0D 8D A0 0D AD 97 0D 6D 10
0AE1:9D 0D 8D A1 0D AE 01 40 39
0AE9:A0 00 A2 00 B1 FD 0D 36 1A
0AF1:0E F0 2B E8 E0 30 D0 F6 9D
0AF9:A2 00 DD F3 0D F0 10 E8 8F
0B01:E0 4F D0 F6 91 FB 20 50 F1
0B09:0C 20 64 0C 4C E9 0A 91 2A
0B11:FB 20 50 0C B1 FD 91 FB 9C
0B19:20 50 0C 4C 0A B1 FB 35
0B21:20 50 0C B1 FD 8D A2 0D 70
0B29:20 56 0C B1 FD 8D A3 0D FB
0B31:20 56 0C 38 AD A0 0D ED E9
0B39:A2 0D 8D A4 0D AD A1 0D 4F
0B41:ED A3 0D 0D A4 0D 90 50 74
0B49:38 AD 96 0D ED A2 0D 8D 2C
0B51:A4 0D AD 97 0D ED A3 0D A0
0B59:0D A4 0D 0B 3B 38 AD A2 84
0B61:0D ED 96 0D 8D A4 0D AD E3
0B69:A3 0D ED 97 0D 8D A5 0D C2
0B71:18 AD 98 0D 6D A4 0D 8D 88
0B79:A6 0D AD 99 0D 6D A5 0D EB
0B81:8D A7 0D A0 0D AD A6 0D 05
0B89:91 FB 20 5D 0C AD A7 0D B4
0B91:91 FB 20 5D 0C 4C 0A 0B F9
0B99:A0 00 AD A2 0D 91 FB 20 A6
0BA1:5D 0C AD A3 0D 91 FB 20 20
0BA9:5D 0C 4C 0A 0B A0 00 B1 28
0BB1:FD 8D A2 0D C8 B1 FD 8D E5
0BB9:A4 0D C8 B1 FD 8D A3 0D 14
0BC1:C8 B1 FD 8D A5 0D 38 AD C0
0BC9:A4 0D ED 96 0D 8D A4 0D 91
0BD1:AD A5 0D ED 97 0D 8D A5 5A
0BD9:0D 18 AD A4 0D 6D 98 0D D8
0BE1:8D A4 0D AD A5 0D 6D 99 3A
0BE9:0D 8D A5 0D A0 00 AD A2 72
0BF1:0D 91 FB C8 AD A4 0D 91 AA
0BF9:FB C8 AD A3 0D 91 FB C8 9F

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0C01:AD A5 0D 91 FB C8 60 20 F7
0C09:8E 0C A9 34 8D AC 0D AE CB
0C11:AC 0D BD AC 0D A8 BD AB 77
0C19:0D 20 A3 0C 20 AE 0B CE 95
0C21:AC 0D CE AC 0D AE AC 0D 01
0C29:D0 E5 60 20 8E 0C A9 12 3B
0C31:8D AC 0D AE AC 0D BD E0 BD
0C39:0D A8 BD DF 0D 20 A3 0C F3
0C41:20 CC 0C CE AC 0D CE AC EE
0C49:0D AE AC 0D D0 E5 60 20 F8
0C51:56 0C 4C 5D 0C E6 FD D0 BF
0C59:02 E6 FE 60 E6 FB D0 02 DC
0C61:E6 FC 60 38 A5 FB ED 9E 53
0C69:0D 8D A2 0D A5 FC ED 9F 2D
0C71:0D 8D A3 0D 38 AD A2 0D 83
0C79:ED 9A 0D 8D A4 0D AD A3 02
0C81:0D ED 9B 0D 0D A4 0D B0 A5
0C89:01 60 68 68 60 AD 96 0D C1
0C91:AE 97 0D 85 FD 86 FE AD 96
0C99:9E 0D AE 9F 0D 85 FB 86 11
0CA1:FC 60 8D A2 0D 8C A3 0D 1B
0CA9:18 AD 9E 0D 6D A2 0D 85 73
0CB1:FB AD 9F 0D 6D A3 0D 85 91
0CB9:FC 18 AD 96 0D 6D A2 0D E5
0CC1:85 FD AD 97 0D 6D A3 0D BD
0CC9:85 FE 60 A0 00 B1 FD 8D CA
0CD1:A4 0D C8 B1 FD 8D A5 0D 32
0CD9:38 AD A4 0D ED 96 0D 8D 50
0CE1:A6 0D AD A5 0D ED 97 0D FC
0CE9:8D A7 0D 18 AD A6 0D 6D 65
0CF1:98 0D 8D A6 0D AD A7 0D 31
0CF9:6D 99 0D 8D A7 0D A0 00 5C
0D01:AD A6 0D 91 FB C8 AD A7 5C
0D09:0D 91 FB 60 A2 14 20 D2 0C
0D11:FF CA D0 FA 38 20 F0 FF CB
0D19:28 A0 0A 18 4C F0 FF 8E 47
0D21:B9 0D 8C 2A D0 A2 00 BD F7
0D29:FF FF F0 66 20 D2 FF E8 F6
0D31:D0 F5 60 A9 0D 4C D2 FF 17
0D39:8E A9 0D 8C AA 0D A0 00 3A
0D41:AD A9 0D D9 7A 0E F0 03 CC
0D49:C8 D0 F8 98 0A 0A 0A 3B
0D51:8D A8 0D A2 00 AD AA 0D 41
0D59:DD 7A 0E F0 03 E8 D0 F8 28
0D61:8A 0D A8 0D 8D A8 0D AD C0
0D69:A8 0D 60 A9 05 20 C3 FF F1
0D71:20 CC FF 20 34 0D A2 21 0D
0D79:A0 0F 20 20 0D A2 39 A0 B3
0D81:F9 20 20 0D 20 E4 FF C9 5E
0D89:5F F0 07 C9 4E D0 F5 4C F7
0D91:10 08 4C F9 09 00 7D 00 22
0D99:40 CD 09 A8 08 00 00 00 B3
0DA1:00 00 00 00 00 00 00 00 BB
0DA9:00 00 00 00 00 00 1E 00 48
0DB1:25 00 89 00 DE 00 A0 01 C8
0DB9:2A 02 48 02 4E 02 54 02 B7
0DC1:5A 02 18 06 2C 06 38 06 DC
0DC9:8B 06 C0 06 EC 06 F3 06 11
0DD1:A7 07 DF 07 E9 07 F3 07 48
0DD9:FD 07 07 08 12 08 34 08 37
0DE1:94 08 96 08 98 08 9A 08 BD
0DE9:9C 08 9E 08 A0 08 A2 08 1B
0DF1:A4 08 A9 A2 A0 A5 B5 A1 68
0DF9:B1 A4 B4 A6 B6 B0 F0 90 02
0E01:C9 C5 D5 C1 D1 D0 A6 B6 20
0E09:85 95 81 91 84 94 86 96 B0
0E11:C6 D6 E6 F6 0C C4 CE 06 26
0E19:E4 EC E9 E5 F5 E1 F1 69 03
0E21:65 75 61 71 30 10 29 25 C9
0E29:35 21 31 09 05 15 01 11 6E

```

```

0E31:49 45 55 41 51 AD BD B9 78
0E39:AC BC 20 CD DD D9 AE BE 2E
0E41:4C 6C 8D 9D 99 8C 8E CE 15
0E49:DE EE FE CC EC ED FD F9 52
0E51:6D 7D 79 2D 3D 39 0D 1D 8B
0E59:19 4D 5D 59 2C 2E 3E 6E 9B
0E61:7E 4E 5E 0E 1E A9 A2 A0 7A
0E69:00 52 41 4D 44 52 49 56 6B
0E71:45 2E 4F 42 4A 2A 20 20 25
0E79:20 30 31 32 33 34 35 36 06
0E81:37 38 39 41 42 43 44 45 6F
0E89:46 8E 08 12 98 20 52 41 B9
0E91:4D 44 52 49 56 45 20 52 9E
0E99:45 4C 4F 43 41 54 4F 52 D5
0EA1:20 92 00 9A 43 4F 50 59 6D
0EA9:52 49 47 48 54 20 31 39 6D
0EB1:39 31 20 43 4F 4D 50 55 94
0EB9:54 45 20 50 55 42 4C 49 EF
0EC1:43 41 54 49 4F 4E 53 00 49
0EC9:05 49 4E 53 45 52 54 20 F5
0ED1:57 4F 52 4B 20 44 49 53 64
0ED9:4B 20 43 4F 4E 54 41 49 90
0EE1:4E 49 4E 47 20 52 41 4D CF
0EE9:44 52 49 56 45 2E 4F 42 0F
0EF1:4A 00 54 48 45 4E 20 50 36
0EF9:52 45 53 53 20 41 20 4B C1
0F01:45 59 20 54 4F 20 43 4F 32
0F09:4E 54 49 4E 55 45 2E 2E BB
0F11:2E 00 9F 4C 4F 41 44 49 50
0F19:4E 47 2E 2E 2E 2E 00 00 1D
0F21:0D 9E 2D 2D 2D 2D 20 44 88
0F29:49 53 4B 20 45 52 52 4F 93
0F31:52 20 2D 2D 2D 2D 00 00 31
0F39:54 52 59 20 41 47 41 49 36
0F41:4E 20 28 59 2F 4E 29 3F 6D
0F49:00 0D 9A 52 45 4C 4F 43 60
0F51:41 54 45 20 41 44 44 52 C5
0F59:45 53 53 20 3A 20 24 00 F5
0F61:9F 52 45 4C 4F 43 41 54 AF
0F69:49 4E 47 2E 2E 2E 00 00 CF
0F71:0D 9A 53 41 56 45 20 46 89
0F79:49 4C 45 20 4E 41 4D 45 51
0F81:3A 20 05 00 9F 53 41 56 88
0F89:49 4E 47 2E 2E 2E 00 32
0F91:41 4E 4F 54 48 45 52 20 2F
0F99:28 59 2F 4E 29 00 2C 50 DE
0FA1:2C 57 00 00 00 00 00 00 AB
0FA9:00 00 00 00 00 00 00 C7
0FB1:00 00 00 00 00 00 00 CF

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1-3-5-7

By Randy Thompson

Can computers learn? It's a thought-provoking question. In a sense, you teach your computer something every time you type in a new program, but is that really learning?

With these questions in mind, I set out to write a program that not only teaches the computer a new trick (to play a game) but also improves its perform-

ance by letting it learn from its mistakes. This program plays a simple game that I call 1-3-5-7 because of the way the game's 16 pieces are arranged—in four rows with one piece in the first row, three pieces in the second row, five pieces in the third row, and seven pieces in the fourth row. The more games of 1-3-5-7 you play against the computer, the better the computer gets at winning.

Getting Started

The program is written entirely in BASIC. Type it in using *The Automatic Proofreader*; see "Typing Aids" elsewhere in this section. When you've finished typing, be sure to save a copy of the program before running it.

When you play for the first time, your computer is a terrible opponent. It knows nothing about what is a good or bad move; it simply strives to make legal moves. At the end of each game, however, the computer reviews the moves both you and it made and attempts to learn from the loser's mistakes and the winner's good strategy. After a number of games, the computer's talent at remembering past events makes it a formidable adversary.

How to Play

The game is easy to learn. Players take turns removing pieces from the board. Remove as many as you like as long as those pieces are taken from one row only. You may remove pieces from any row, and you must take at least one piece. The player who removes the last piece loses the game.

When you run 1-3-5-7, the computer asks you if you want to load any previous game experience. This is a file that you can create after playing a few games and then exiting 1-3-5-7.

The game operates from a menu containing six options: Human Moves First, Computer Moves First, Human vs. Human, Computer vs. Computer, Auto-Learn Mode, and Quit.

In the first two options, you play against the computer. If you have not loaded a knowledge file, the computer selects legal moves totally at random (it doesn't know any better). Against a reasonably aware opponent, the computer nearly always loses. It *can* win, but it rarely does.

Beating the computer is not the

idea, however. It's your job to improve the computer's game through example. The computer considers any move that you make during a winning game to be a good one. Conversely, all moves made by the losing player are seen as bad moves. If you play a game perfectly, only to make a foolish move at the end, the computer will remember all your moves as being undesirable, and your teaching task will become much more difficult. If you wish to bring your computer up to speed as soon as possible, you must show no mercy and always play your best.

To make a move, you first select a row by pressing the A, B, C, or D key (the rows are labeled this way on the screen). Next, select the number of pieces you want to remove using the computer's number keys. When you've made your selections, press Return to accept the move; press any other key to start over and reenter your move. When the game is over, the computer announces the winner and returns you to the game's main menu.

Other Options

Option 3, Human vs. Human, allows you to play against another carbon-based opponent, such as your best friend. The computer still observes the game while you play this mode, so its expertise improves even though it's not an active participant.

Computer vs. Computer pits the computer against itself. It's a good option to choose when you want to check for weak spots in your computer's game strategy. By watching the computer play, you might learn a few tricks yourself. In Auto-Learn mode, the computer and a spurious opponent named Mr. Random take turns going first and continue playing until they are told to stop. To halt Auto-Learn mode, press the Back Arrow key. This is an excellent mode to select when you want to start building an experience file. Keep in mind that, while Mr. Random is a tireless player, he is hardly a good role model for your computer. Therefore, even after several hours of competition with Mr. Random, your computer will still need some careful tutoring to become a really good player.

When you select the Quit option, the computer asks you if you want to save

the current game experience to disk. If you answer Yes, you are asked to enter a filename. By using distinct filenames, you can create different experience files for various levels of play.

How It Works

The program keeps track of the current board position in the string variable BD\$. Each time a player moves, BD\$ is updated. The board position is stored as four characters. The first character reflects the number of pieces in row A, the second character reflects the number of pieces in row B, and so on. Thus, the initial board position is represented as 1357. If you removed three pieces from row B as your first move, 1057 would be the resulting board position. The four board positions 1000, 0100, 0010, and 0001 signify the end of the game.

In order for the computer to learn from a game, it must keep track of the game's moves. Each move is stored in the string array GM\$(). The first move of the game is stored in GM\$(1), the second move in GM\$(2), and so on. The current move number is kept in the variable MV, so the current move is referenced with the statement GM\$(MV).

The game's moves are stored in a seven-character format. The first four characters represent the board position in exactly the same way board positions are represented by BD\$. The fifth character is always a space. The sixth character represents the row, and the seventh and last character specifies the number of pieces removed from that row. If you remove four pieces from row C as the first move in the game, for example, the string 1357 C4 would be loaded into GM\$(MV).

How It Learns

This program learns from experience: Good behavior (winning) is rewarded, and bad behavior (losing) is punished. In order for the program to remember what is good and bad behavior, I had to supply the program with a memory or brain. The brain of 1-3-5-7 is the string array WM\$(). Winning moves are moved into the array, while losing moves are shoved out. At the start of the program, this array is empty.

Think of each array element in WM\$() as a brain cell, where one

brain cell stores the possible winning moves for one particular board position. Accessing a brain cell is relatively easy. For example, the winning moves (or at least what the computer thinks are winning moves) for board position 1345 are stored in WM\$(1345). So, at any time during the game, WM\$(VAL(BD\$)) returns the winning moves (if any) for the current board position. (Note of interest: With 383 possible board positions and 1357 brain cells, only about 3 percent of the program's brain cells are actually ever used. Remind you of anyone?)

Winning moves are stored in WM\$() in the same format as game moves are stored in the last two characters of the GM\$() array. Several moves may be stored in one WM\$() brain cell. For example, the board position indicated by WM\$(1536) may contain C3B1A1C1B2 as its winning moves. This example offers the five moves C3, B1, A1, C1, and B2. It's possible that there will be just one winning move (or none) stored for any one board position.

Brain cells organize moves in order of preference; superior moves appear ahead of inferior moves. Using the previous example, we see that the 1-3-5-7 program prefers the move C3 over B1, B1 over A1, and so on. Hoping to make the best move possible, this program always uses the first move found in a brain cell.

After each game, 1-3-5-7 updates its brain cells in response to the outcome. Each move made by the winning player is placed into the brain cell corresponding to the board position in which the move was made. Consider the case when the player removes one piece from row A in the following board position:

- A) I
- B) III
- C) III
- D) IIIII

The string A1 is placed into WM\$(1230). If WM\$(1230) already contains the move A1, then the A1 is bumped up by one move in the list. If the move A1 is already the first move in the list, no change is made. If A1 is not already in the list, then A1 is placed as the first move in the list.

Each move made by the losing player is demoted in the brain cell corresponding to the board position in which the move was made. For example, let's say that the losing player removes two pieces from row C in the following board position:

- A) I
- B) III
- C) III
- D) IIIII

The string C2 is moved to the right or removed from WM\$(1335). If WM\$(1335) contains the move C2, then the move is bumped down a notch. If C2 is the last move in the list, it is removed from the list. If C2 is not in the list, no change is made.

Through this positive and negative reinforcement, the computer modifies its playing style, improves its performance, and—in its own cybernetic way—learns. Try to be a good teacher.

1-3-5-7

```

AS 0 CLR
CS 50 REM COPYRIGHT 1991 - COM
    PUTE PUBLICATIONS INTL L
    TD - ALL RIGHTS RESERVED
JP 100 GOSUB1750:GOSUB1210
KA 110 GOSUB1530:GOSUB300
RP 120 PRINT PL$(OP,PL);";S MO
    VE":PRINT
EJ 130 ON (OP*2)+PL GOSUB420,5
    90,590,420,420,420,590,
    590,590,690
HJ 140 GM$(MV)=BD$+" "+CHR$(R+
    64)+CHR$(N+48)
SR 150 MV=MV+1:PL=ABS(PL-3)
CD 160 GOSUB860:GOSUB300
BK 170 IF EG=0 THEN120
JF 180 NM=MV-1
GG 190 REM
EJ 200 REM ANNOUNCE WINNER
DG 210 REM
BA 220 PRINT "AND THE WINNER I
    S..."
RE 230 PRINT:PRINT PL$(OP,ABS(
    PL-3))
SD 240 GOSUB940
PG 250 GET K$:IF OP=4 AND K$<>
    "<" THEN110
PP 260 OP=0
EQ 270 PRINT "{9 DOWN}
    {6 SPACES}= PRESS RETUR
    N TO CONTINUE =";
AF 280 GET K$:IF K$<>CHR$(13)
    {SPACE}THEN280
BD 290 GOTO110
JP 300 REM
  
```

```

HG 310 REM DISPLAY BOARD
AR 320 REM
FD 330 PRINT CHR$(147)
PF 340 PRINT:PRINT
CQ 350 FOR I=1 TO 4
AM 360 N=VAL(MID$(BD$,I,1))
AM 370 PRINT CHR$(I+64);";" ";L
    EFT$("-----",N)
RA 380 PRINT
PX 390 NEXT I
MA 400 PRINT
EX 410 RETURN
QD 420 REM
XR 430 REM GET HUMAN'S MOVE
EF 440 REM
DM 450 PRINT "ROW: ";
FG 460 GET K$:IF K$<"A" OR K$>
    "D" THEN460
AG 470 R=ASC(K$)-64
HR 480 X=VAL(MID$(BD$,R,1))
MM 490 IF VAL(BD$)=INT(10↑(4-R
    )*X) THEN X=X-1
SP 500 IF X=0 THEN460
MB 510 PRINT K$:R=ASC(K$)-64
PR 520 PRINT "NUMBER TO REMOVE
    : ";
KE 530 GET K$:IF K$<"1" OR K$>
    CHR$(X+48) THEN530
CQ 540 PRINT K$:N=VAL(K$)
MQ 550 PRINT "{8 DOWN}
    {7 SPACES}= PRESS RETUR
    N TO ACCEPT =";
HK 560 GET K$:IF K$="" THEN560
SC 570 IF K$<>CHR$(13) THEN GO
    SUB300:PRINT PL$(OP,PL)
    ;";S MOVE":PRINT:GOTO42
    0
QP 580 RETURN
DX 590 REM
JM 600 REM GET COMPUTER'S MOVE
SX 610 REM
XJ 620 BD=VAL(BD$):MV$=WM$(BD)
SX 630 IF MV$="" THEN690
JB 640 R=ASC(MID$(MV$,1,1))-64
    :N=VAL(MID$(MV$,2,1))
EG 650 PRINT "ROW: ";CHR$(64+R)
HB 660 PRINT "NUMBER TO REMOVE
    : ";N
KS 670 IF OP<>4 THEN FOR I=1 T
    O 1000:NEXT I
JA 680 RETURN
BF 690 REM
DP 700 REM GET RANDOM MOVE
GF 710 REM
GB 720 A$=""
EE 730 FOR I=1 TO 4
XF 740 R$=MID$(BD$,I,1)
JD 750 IF R$<>"0" THEN A$=A$+C
    HR$(I+48)
RG 760 NEXT I
QE 770 IF LEN(A$)=1 THEN R=VAL
    (A$):GOTO790
CP 780 R=VAL(MID$(A$,INT(RND(1
    )*LEN(A$))+1,1))
JB 790 X=VAL(MID$(BD$,R,1))
BJ 800 IF VAL(BD$)=INT(10↑(4-R
    )*X) THEN X=X-1
GS 810 N=INT(RND(1)*X)+1
  
```



```

SK 820 PRINT "ROW:";CHR$(64+R)
SH 830 PRINT "NUMBER TO REMOVE
      :";N
QK 840 IF OP<>4 THEN FOR I=1 TO
      1000:NEXT I
SM 850 RETURN
HX 860 REM
SK 870 REM EXECUTE MOVE AND CH
      ECK FOR WIN
SB 880 REM
GE 890 CN=VAL(MID$(BD$,R,1))
CJ 900 CN=CN-N
RJ 910 BD$=MID$(BD$,1,R-1)+CHR
      $(CN+48)+MID$(BD$,R+1,4
      )
HS 920 IF BD$="1000" OR BD$="0
      100" OR BD$="0010" OR B
      D$="0001" THEN EG=1
MB 930 RETURN
FE 940 REM
FQ 950 REM LEARN FROM GAME
RG 960 REM
FC 970 REM{4 SPACES}REWARD WIN
      NING MOVES
DB 980 MV=MV-1:IF MV=0 THEN RE
      TURN
CK 990 BD=VAL(LEFT$(GM$(MV),4
      ))
EH 1000 MV$=RIGHT$(GM$(MV),2)
SC 1010 F=0:A$=WM$(BD):IF A$="
      " THEN A$=MV$:GOTO1080
GK 1020 FOR I=1 TO LEN(A$) STE
      P 2
PA 1030 IF MID$(A$,I,2)=MV$ TH
      EN F=I
MM 1040 NEXT I
XK 1050 IF F=0 THEN A$=MV$+A$:
      GOTO1080
PF 1060 IF F=1 THEN1080
DC 1070 A$=LEFT$(A$,F-3)+MV$+M
      ID$(A$,F-2,2)+MID$(A$,
      F+2)
GR 1080 WM$(BD)=A$
EG 1090 REM{4 SPACES}PUNISH LO
      SING MOVES
GD 1100 MV=MV-1:IF MV=0 THEN R
      ETURN
FR 1110 BD=VAL(LEFT$(GM$(MV),4
      ))
EX 1120 MV$=RIGHT$(GM$(MV),2)
JK 1130 F=0:A$=WM$(BD):IF A$="
      " THEN970
HB 1140 FOR I=1 TO LEN(A$) STE
      P 2
PJ 1150 IF MID$(A$,I,2)=MV$ TH
      EN F=I
PC 1160 NEXT I
AC 1170 IF F=0 THEN970
XD 1180 IF F+1=LEN(A$) THEN WM
      $(BD)=LEFT$(WM$(BD),F-
      1):GOTO970
FQ 1190 WM$(BD)=LEFT$(A$,F-1)+
      MID$(A$,F+2,2)+MV$+MID
      $(A$,F+4)
KR 1200 GOTO970
SX 1210 REM
AR 1220 REM LOAD EXPERINCE
DA 1230 REM

KQ 1240 PRINT CHR$(147)
KD 1250 PRINT "LOAD PREVIOUS G
      AME EXPERIENCE? ";
EX 1260 GET K$:IF K$<>"Y" AND
      {SPACE}K$<>"N" THEN126
      0
PD 1270 IF K$="N" THEN PRINT "
      NO":FOR I=1 TO 500:NEX
      T I:GOTO1350
DJ 1280 PRINT "YES":PRINT:INPU
      T "FILENAME";A$:IF A$=
      "" THEN1350
DA 1290 OPEN 15,8,15
AG 1300 OPEN 1,8,2,A$+".AI",S,R
      "
DH 1310 INPUT#15,E,E$
MD 1320 IF E THENPRINT"* ";E$;
      " *":FOR I=1TO2500:NEX
      T I:CLOSE1:CLOSE15:GOT
      O1210
MP 1330 INPUT#1,BD:INPUT#1,MV$
      :WM$(BD)=MV$:IF ST=0 T
      HEN1330
HG 1340 CLOSE 1:CLOSE 15
DE 1350 RETURN
AK 1360 REM
KD 1370 REM SAVE EXPERIENCE
MP 1380 REM
FM 1390 PRINT CHR$(147)
MD 1400 PRINT "SAVE GAME EXPE
      RIENCE? ";
DR 1410 GET K$:IF K$<>"Y" AND
      {SPACE}K$<>"N" THEN141
      0
KA 1420 IF K$="N" THEN PRINT "
      NO":GOTO1520
XC 1430 PRINT "YES":PRINT:INPU
      T "FILENAME";A$:IF A$=
      "" THEN1520
ME 1440 OPEN 15,8,15,"S0:"+A$+
      ".AI"
FA 1450 OPEN 1,8,2,A$+".AI",S,W
      "
QR 1460 INPUT#15,E,E$
BJ 1470 IF E THENPRINT"* ";E$;
      " *":FOR I=1TO2500:NEX
      T I:CLOSE1:CLOSE15:GOT
      O1360
SK 1480 FOR I=1 TO 1357
RB 1490 IF WM$(I)<>" " THEN PRI
      NT#1,I:PRINT#1,WM$(I)
GK 1500 NEXT I
MQ 1510 CLOSE 1:CLOSE 15
SS 1520 RETURN
QE 1530 REM
BC 1540 REM PREPARE FOR NEW GA
      ME
GF 1550 REM
BF 1560 BD$="1357"
AJ 1570 FOR I=1 TO NM:GM$(I)="
      ":NEXT I
KS 1580 MV=1
EG 1590 EG=0
PS 1600 IF OP=4 THEN WF=ABS(WF
      -3):PL=WF:GOTO1740
PQ 1610 PL=1
XR 1620 WF=1
XP 1630 PRINT CHR$(147);"{WHT}
      {7 SPACES}1-3-5-7
      {6 SPACES}"
DF 1640 PRINT
JS 1650 PRINT:PRINT "
      {2 SPACES}1) HUMAN MOV
      ES FIRST"
SH 1660 PRINT:PRINT "
      {2 SPACES}2) COMPUTER
      {SPACE}MOVES FIRST"
BC 1670 PRINT:PRINT "
      {2 SPACES}3) HUMAN VS
      {SPACE}HUMAN"
AA 1680 PRINT:PRINT "
      {2 SPACES}4) COMPUTER
      {SPACE}VS COMPUTER"
CF 1690 PRINT:PRINT "
      {2 SPACES}5) AUTO-LEAR
      N MODE"
KA 1700 PRINT:PRINT "
      {2 SPACES}6) QUIT"
EX 1710 GET K$:IF K$<"1" OR K$
      >"6" THEN1710
QG 1720 IF K$="6" THEN GOSUB13
      60:PRINT:PRINT "THANKS
      FOR PLAYING":END
GS 1730 OP=VAL(K$)-1
HX 1740 RETURN
KC 1750 REM
DJ 1760 REM INITIALIZE PROGRAM
XE 1770 REM
FP 1780 X=RND(-TI)
JG 1790 DIM WM$(1357)
PH 1800 DIM GM$(15)
GG 1810 DIM PL$(4,2)
JD 1820 RESTORE
HA 1830 FOR OP=0 TO 4:FOR PL=1
      TO 2:READ PL$(OP,PL):
      NEXT PL:NEXT OP
AF 1840 RETURN
QG 1850 DATA THE HUMAN,THE COM
      PUTER
GH 1860 DATA THE COMPUTER,THE
      {SPACE}HUMAN
HQ 1870 DATA HUMAN1,HUMAN2
RR 1880 DATA COMPUTER1,COMPU
      TER2
HC 1890 DATA THE COMPUTER,MR.
      {SPACE}RANDOM

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Randy Thompson is the editor of Gazette's "Programmer's Page." He lives in Eugene, Oregon. □

SPORT CARD COLLECTOR

By Kevin Scott Davis
Sport card collecting is a fun and profitable hobby enjoyed by millions of Americans. One of the least enjoyable parts of card collecting, however, is cataloging that collection. The usual method is to keep the inventory and prices on paper, but that can be a headache. The problem comes when it is time to make

changes. It can be a messy and time-consuming task.

Sport Card Collector was designed to eliminate these problems. It becomes much easier to alter card inventory and prices when the 64 lends a hand. *Collector* also can evaluate the value of your collection based on the prices you enter, and it can print out an orderly inventory. The program tracks card names, the number of cards and their condition, and price.

Getting Started

Sport Card Collector is written entirely in BASIC. To type it in, use *The Automatic Proofreader*; see "Typing Aids" elsewhere in this section. Be sure to save a copy of the program when you've finished typing.

Options

When you run the program, you are presented with the main menu. Option 1 on the menu allows you to load a new data file. If the memory is not empty, you will be prompted to erase it. You'll be asked for the set year and name (see option 3 for more details), and then the program will load. A counter will show you how many records (number of cards) exist in the set and which record is being read. (If you enter a filename that does not exist, you'll have to reload the program.)

Option 2 is Edit File. You'll first be asked if you want to start a new file. Again, you won't be able to do this if a file is still in memory. If your answer is Yes, you'll be asked how many records exist in the set. The counter will indicate the numbers as the file is created.

The next option is to edit entire file or prices only. The Entire File option is used to edit all seven fields of the record: Card Name, Number of Cards in Mint Condition, Number in Near Mint, Number in Excellent/Good, Number in Fair/Poor, Low Price, and High Price.

If you have not differentiated the conditions of your cards, enter the total number in the Mint field and ignore the others (a 0 is automatically registered). You must use Entire File when entering data on a new file or changing the number of cards. If you're merely making changes, it's not necessary to reenter all the previously entered data.

When you enter the card number to

edit, you'll be shown the existing data in that record. Hitting Return at any prompt will keep the data currently shown. In the Prices Only mode, you only edit the low and high prices in each record. This is much faster than editing the entire file. In either edit mode, enter a 0 at the Card to Edit prompt to return to the main menu.

Option 3 allows you to save your file. It will ask for the set year and name. The year can be any length, but usually two digits will suffice. The set name is limited to five characters. A total of seven characters is enough to identify a file, though. My 1990-91 Sky Box file, for example, is called 91SKYBX. (For a convenience to disk subscribers, this 45-block file has been included on this month's *Gazette Disk*.) If the program senses a file with the same name on the disk drive, the older one will be scratched. As the file is saved, the counter shows you the record being saved at any moment.

Option 4 prints out the file in memory. You'll be asked for a data line to be printed at the bottom of the printout. This is ideal for identifying the set year/name, date of prices, and so on. If there's no file in memory, the option will not work from the main menu.

When you're ready to print, you'll be offered two choices of printouts. One is for separate card conditions, which prints different columns for mint, near mint, and so on. The second adds the four card fields and prints the total number of cards. Make sure the printer is on and set to device 4 before hitting Return after entering your choice. The printer can print approximately 65 records per page. At the end of the listing, the set value will be calculated and printed, as explained in option 5.

Option 5 evaluates the set's worth. This calculation will depend on the values you've entered for each card. This program was designed around the standards of the *Beckett* card magazines, the industry benchmark. Of course, you can use any price values you care to assign as long as they include high and low values.

Just as with the *Beckett* prices, the figure given by this option is merely a guide to your collection's value. You may not be able to sell your set for these prices. This option works by tak-

ing the number of cards you have in each category, multiplying the number to obtain a high value and low value, and then multiplying by percentage allowances for card conditions.

The allowances are 100 percent of price for mint cards, 75 percent for near mint, 60 percent for excellent/good, and 10 percent for fair/poor. While these are not exactly *Beckett* standards, incorporating all eight card conditions would take too much memory to be efficient. There is also too much overlap in the percentages in the eight fields to be included. If you use different percentages for card grading (such as the higher percentages for older cards), change the values in lines 2000 and 2020. While the values are being calculated, a counter shows you the progress of the program. The prices are shown; then press any key to return to the program's menu.

Option 6 allows you to view the records of the file in memory. You'll be asked for the card number to view. You'll be shown the seven fields of the record for which you prompt. You can then request another record or enter 0 to return to the menu.

Option 7 erases any data in memory. You will be asked to confirm this option. Once the data is erased, there is no way to retrieve it, so be careful!

64 and 128 Modes

Sport Card Collector will run in both the 64 and the native 128 modes. In the 128 mode, you have access to the keypad. As 80 percent of all data entry is entered by number, I find the keypad makes data entry easier and faster.

The main advantage of the 128 is its larger memory. It can handle approximately 1800 cards. I would not recommend more than 750 cards per file in 64 mode. (I break up the few sets with more than 750 cards into two files, such as 89TOPP1 and 89TOPP2). *Collector* may occasionally appear to lock up with the counter stuck on card number 1. Be patient, though; in less than ten seconds the program will continue.

I use this program to hold my own basketball card records. The longest task when using this program is entering the data for the first time. Then be prepared to spend several hours at the computer the first time you edit a file.

Of course, you can save an incomplete file to disk and then reload it later and finish the job of entering data.

Once a file is set up, changing prices from month to month is quick and easy. Each month *Beckett* prints its list of prices with up and down arrows to indicate changes from the previous month. Once you have the hang of it, an entire file can be updated quickly.

Older sets are not as volatile; therefore, they may not need their value updated every month. Just as with collecting itself, you can get as much out of this program as you are willing to put into it. I've found it easy to carry my inventory printout to card stores and sport card conventions. My friends and other collectors find the printout easy to read, and it shows them which cards have duplicates that I might be willing to put up for trade.

SPORT CARD COLLECTOR

```

AS 0 CLR
KP 5 REM COPYRIGHT 1991 - COMP
    UTE PUBLICATIONS INTL LTD
    - ALL RIGHTS RESERVED
CC 10 YL=0
KG 20 POKE 53280,0:POKE53281,0
AQ 30 PRINT (CHR$(147))
JE 40 PRINT "{3 DOWN}
    {10 SPACES}{8}UDDDDDDDDDD
    DDDDDDDDDDDI"
KM 50 PRINT "{10 SPACES}{8}G
    {5 SPACES}{RVS} {P}
    {OFF} {RVS}{V}{P}{C}
    {OFF} {RVS}{V}{P}{C}
    {OFF} {8}{3 SPACES}H"
RC 60 PRINT "{10 SPACES}G
    {5 SPACES}{RVS} {OFF}
    {2 O} {RVS} {OFF}
    {3 SPACES}{RVS} {OFF}
    {6 SPACES}H"
AE 70 PRINT "{10 SPACES}G
    {5 SPACES}{I}{P}{RVS}
    {OFF} {RVS}{F}{Y}{D}
    {OFF} {RVS}{F}{Y}{D}
    {OFF}{4 SPACES}H"
SA 80 PRINT "{10 SPACES}GEEEEEE
    EEEEEEEEEEEEEH"
DH 90 PRINT "{10 SPACES}GSPORT
    {SPACE}CARD COLLECTORH"
QS 100 PRINT "{10 SPACES}{Q}DDD
    DDDDDDDDDDDDDDDDD{W}"
CX 110 PRINT "{10 SPACES}G{RVS}
    [1] LOAD FILE{7 SPACES}
    {OFF}H"
BS 120 PRINT "{10 SPACES}G{RVS}
    [2] EDIT FILE{7 SPACES}
    {OFF}H"
KX 130 PRINT "{10 SPACES}G{RVS}
    [3] SAVE FILE{7 SPACES}

```

```

{OFF}H"
BA 140 PRINT "{10 SPACES}G{RVS}
    [4] PRINT FILE
    {6 SPACES}{OFF}H"
KC 150 PRINT "{10 SPACES}G{RVS}
    [5] EVAL. SET PRICE
    {OFF}H"
HD 160 PRINT "{10 SPACES}G{RVS}
    [6] VIEW FILE{7 SPACES}
    {OFF}H"
DF 170 PRINT "{10 SPACES}G{RVS}
    [7] ERASE MEMORY
    {4 SPACES}{OFF}H"
JB 180 PRINT "{10 SPACES}JFFFFFFF
    FFFFFFFF"
BF 190 IF F$="" THEN XW$="**NO
    NE**"
SK 200 PRINT "{9 SPACES}FILE IN
    MEMORY: "XW$
MB 210 PRINT:PRINT "{13 SPACES}
    CHOOSE: [1 TO 7]"
HK 220 GET X$:IF X$="" THEN 22
    0
BK 230 X=VAL(X$):IF X<1 OR X>7
    THEN 20
SX 240 ON X GOTO 250,560,1120,
    1380,1880,2200,2150
QD 250 REM LOAD FILE
MG 260 PRINT "{CLR}{15 SPACES}L
    OAD FILE":PRINT
DF 270 PRINT:ENTER SET YEAR
    {WHT}"
HD 280 POKE19,65:INPUT SY$:PRI
    NT:PRINT "{8}ENTER SET N
    AME [MAX 5 CHARS.]{WHT}
    "
HC 290 POKE19,65:INPUT SN$
QC 300 IF XW$<>"**NONE**" THEN
    PRINT:PRINT "{8}MUST ER
    ASE MEMORY FIRST!"
KE 310 IF XW$<>"**NONE**" THEN
    PRINT:PRESS ANY KEY TO
    GO TO MAIN MENU"
AE 320 IF XW$<>"**NONE**" THEN
    GET HY$
HB 330 IF XW$<>"**NONE**" AND
    {SPACE}HY$="" THEN 320
DE 340 IF XW$<>"**NONE**" THEN
    20
QX 350 PRINT:PRINT:PRINT "{8}IN
    SERT DISK AND PRESS A K
    EY/'N' ABORTS"
AM 360 GET K$:IF K$="" THEN 36
    0
MK 370 IF K$="N" THEN 20
CC 380 F$=SY$+SN$:OPEN8,8,F$
    +",S,R"
MR 390 INPUT#8,YT:INPUT#8,GC
GB 400 GOSUB 2360
SA 410 PRINT "{CLR}":PRINT "{8}T
    OTAL RECORDS IN THE SET
    : "YT
HF 420 RN=1
AF 430 PRINT "ON RECORD NUMBER:
    {WHT} 1"
DJ 440 FOR TM=1 TO YT
RS 450 INPUT#8,CM$(TM):INPUT#8
    ,MT$(TM):INPUT#8,NM$(TM)

```

```

):INPUT#8,GD$(TM)
DP 460 INPUT#8,FP$(TM):INPUT#8
    ,LO$(TM):INPUT#8,HI$(TM)
CH 470 PRINT "{WHT}{HOME}
    {2 DOWN}{17 RIGHT}"TM
KF 480 NEXT TM
MS 490 CLOSE8
SB 500 OPEN15,8,15:INPUT#15,EN
    ,EM$,ET,ES
FS 510 PRINT:PRINT:PRINT:PRINT
    "{8}DRIVE STATUS:":PRIN
    TEN;EM$;ET;ES
MC 520 CLOSE15:PRINT:PRINT "PRE
    SS ANY KEY TO CONTINUE"
KG 530 GET W0$:IF W0$="" THEN
    {SPACE}530
XF 540 XW$=F$
AF 550 GOTO 20
DM 560 REM EDIT FILE
AD 570 PRINT "{CLR}"
SH 580 PRINT "{8}START BRAND NE
    W FILE?? [Y/N]"
CH 590 GET YN$:IF YN$="" THEN
    {SPACE}590
FK 600 IF YN$="Y" AND XW$<>"**
    NONE**" THEN PRINT "ERAS
    E MEMORY FIRST! [HIT AN
    Y KEY]"
RP 610 IF YN$="Y" AND XW$<>"**
    NONE**" THEN GOTO 2570
KS 620 IF YN$="Y" THEN INPUT
    "{8}HOW MANY CARDS?{WHT}
    ";YT:F$="WORK":XW$="WOR
    K":GOSUB2360
XM 630 IF YN$="Y" THEN GOSUB 2
    490
FP 640 PRINT "{8}EDIT [1] ENTIR
    E FILE{2 SPACES}[2] PRI
    CES ONLY{WHT}{2 SPACES}
    "
JB 650 POKE19,65:INPUT TE$:TE=
    VAL(TE$):IF TE=2 THEN 9
    70
MK 660 PRINT:PRINT "{8}CARD NUM
    BER TO EDIT [0 TO EXIT]"
EH 670 PRINT "THERE ARE "YT"CARD
    S IN THE SET.{WHT}"
DB 680 POKE19,65:INPUT CE$:CE=
    VAL(CE$)
HP 690 IF CE=0 THEN 20
EB 700 IF CE>YT OR CE<0 THEN 6
    60
SA 710 PRINT "{CLR}{8}CARD NUMB
    ER: "CE:PRINT CM$(CE):P
    RINT "# IN MINT:
    {6 SPACES}MT$(CE)
XF 720 PRINT "# IN NRMT:
    {6 SPACES}NM$(CE)
FD 730 PRINT "# IN GOOD:
    {6 SPACES}GD$(CE):PRIN
    T "# IN FAIR/POOR: "FP$(
    CE)
EP 740 PRINT "LOW PRICE:
    {6 SPACES}"LO$(CE):PRIN
    T "HIGH PRICE:{5 SPACES}
    "HI$(CE)

```


PROGRAMS

```

QX 750 PRINT:PRINT"CARD NUMBER
";CE
GE 760 PRINT"NAME [LESS THAN 2
0 CHARACTERS]{WHT}":POK
E19,65
AQ 770 INPUT CM$(CE):IF LEN(CM
$(CE))>20 THEN 760
RH 780 PRINT:PRINT"{8}NUMBER O
F CARDS IN MINT{WHT}"
KS 790 INPUT MT$(CE)
SJ 800 IF MT$(CE)="" THEN MT$(
CE)=""
ME 810 PRINT:PRINT"{8}NUMBER O
F CARDS IN NEARMINT
{WHT}"
RP 820 INPUT NM$(CE)
JA 830 IF NM$(CE)="" THEN NM$(
CE)=""
CF 840 PRINT:PRINT"{8}NUMBER O
F CARDS IN EXC./GD.
{WHT}"
JA 850 INPUT GD$(CE)
EP 860 IF GD$(CE)="" THEN GD$(
CE)=""
PP 870 PRINT:PRINT"{8}NUMBER O
F CARDS IN FAIR/PR.
{WHT}"
PK 880 INPUT FP$(CE)
EE 890 IF FP$(CE)="" THEN FP$(
CE)=""
DE 900 PRINT:PRINT"{8}LOW VALU
E{WHT}"
JR 910 INPUT LO$(CE)
FR 920 IF LO$(CE)="" THEN LO$(
CE)=""
SP 930 PRINT:PRINT"{8}HIGH VAL
UE{WHT}"
QK 940 INPUT HI$(CE)
GP 950 IF HI$(CE)="" THEN HI$(
CE)=""
CC 960 GOTO 660
DQ 970 REM EDIT PRICES ONLY
DR 980 PRINT"{CLR}"
PB 990 PRINT"{8}CARD NUMBER TO
EDIT [0 TO EXIT]"
PX 1000 PRINT"THREE ARE"YT"CAR
DS IN THE SET.{WHT}":P
OKE19,65:INPUT CE
RP 1010 IF CE=0 THEN 20
SD 1020 PRINT"{8}CURRENT: "
GP 1030 PRINT"PLAYER NAME: "CM
$(CE)
XH 1040 PRINT"LOW PRICE:
{3 SPACES}"LO$(CE)
FJ 1050 PRINT"HIGH PRICE:
{2 SPACES}"HI$(CE)
HR 1060 PRINT:PRINT"INPUT NEW
{SPACE}PRICES":PRINT
QR 1070 PRINT"LOW VALUE{WHT}"
JF 1080 POKE19,65:INPUT LO$(CE)
HP 1090 PRINT"{8}HIGH VALUE
{WHT}"
KA 1100 INPUT HI$(CE)
BS 1110 PRINT:GOTO 990
GC 1120 REM SAVE FILE
AR 1130 IF XW$="***NONE***"THEN
{SPACE}PRINT"NO FILE E
XISTS! [HIT ANY KEY]"
FX 1140 IF XW$="***NONE***" THEN
GOTO 2570
JR 1150 PRINT"{CLR}{15 SPACES}
SAVE FILE":PRINT
MX 1160 PRINT"{8}ENTER SET YEA
R{WHT}"
FQ 1170 POKE19,65:INPUT SY$:PR
INT:PRINT"{8}ENTER SET
NAME [MAX 5 CHARS.]
{WHT}"
ME 1180 INPUT SN$:IF LEN(SN$)>
5 THEN 1180
FA 1190 PRINT:PRINT:PRINT"{8}I
NSERT DISK AND PRESS A
KEY/'N' ABORTS"
KK 1200 GET K$:IF K$="" THEN 1
200
BD 1210 IF K$="N" THEN 20
GC 1220 GOSUB 2350
HX 1230 F$=SY$+SN$:XW$=F$:OPEN
8,8,8,F$+"S,W"
RK 1240 PRINT#8,YT:PRINT#8,GC
KC 1250 PRINT"{CLR}":PRINT"TOT
AL RECORDS IN THE SET:
"YT
GH 1260 PRINT"ON RECORD NUMBER
:{WHT} 1"
PQ 1270 FOR TL=1 TO YT
BC 1280 PRINT#8,CM$(TL):PRINT#
8,MT$(TL):PRINT#8,NM$(
TL):PRINT#8,GD$(TL)
QK 1290 PRINT#8,FP$(TL):PRINT#
8,LO$(TL):PRINT#8,HI$(
TL)
JC 1300 PRINT"{HOME}{2 DOWN}
{17 RIGHT}"TL
FD 1310 NEXT TL
KK 1320 CLOSE8
SH 1330 OPEN15,8,15:INPUT#15,E
N,EM$,ET,ES
XE 1340 PRINT:PRINT:PRINT:PRIN
T"{8}DRIVE STATUS:":PR
INTEN;EM$;ET;ES
JF 1350 CLOSE15:PRINT:PRINT"PR
ESS ANY KEY TO CONTINU
E"
KE 1360 GET WO$:IF WO$="" THEN
1360
PS 1370 GOTO 20
JX 1380 REM PRINTOUT
QX 1390 IF XW$="***NONE***" OR F
$="***NONE***" THEN 20
GG 1400 PRINT"{CLR}"
QB 1410 PRINT"{13 SPACES}HARD
{SPACE}COPY"
FH 1420 PRINT"{2 SPACES}THIS W
ILL PRINT THE FILE IN
{SPACE}MEMORY"
AD 1430 PRINT"{2 SPACES}MAKE S
URE YOUR PRINTER IS ON
DEV 4"
ER 1440 PRINT:PRINT"ENTER YOUR
DATA LINE [UNDER 40 C
HARS.]{WHT}"
HE 1450 POKE19,65:INPUT DL$:IF
LEN(DL$)>40 THEN 1440
HC 1460 PRINT:PRINT:PRINT:PRIN
T"{8}CHOOSE [1] SEP. C
ARD COND. [2] STANDARD
{WHT}"
FA 1470 POKE19,65:INPUT VR:IF
{SPACE}VR=2 THEN 1720
FJ 1480 PRINT:PRINT"{9 SPACES}
THEN PRESS ANY KEY"
FE 1490 GET WE$:IF WE$="" THEN
1490
JF 1500 OPEN4,4
QF 1510 GH$=CHR$(14)
GK 1520 PRINT#4,"":PRINT#4,"":
PRINT#4,CHR$(14) "
{10 SPACES}SPORT CARD
{SPACE}COLLECTOR"
KE 1530 PRINT#4,CHR$(14) "
{39 T}"CHR$(15)
DC 1540 PRINT#4,GH$C# CARD-NA
ME #MT #NM #EG #FP LO
{3 SPACES}HI{2 SPACES}
"CHR$(15)
BA 1550 FOR TP=1 TO YT
DR 1560 PRINT#4,CHR$(16)"01"+S
TR$(TP);
CC 1570 PRINT#4,CHR$(16)"08"+C
M$(TP);
GR 1580 PRINT#4,CHR$(16)"28"+M
T$(TP);
KC 1590 PRINT#4,CHR$(16)"36"+N
M$(TP);
HM 1600 PRINT#4,CHR$(16)"44"+G
D$(TP);
HJ 1610 PRINT#4,CHR$(16)"52"+F
P$(TP);
BK 1620 PRINT#4,CHR$(16)"58"+L
O$(TP);
GX 1630 PRINT#4,CHR$(16)"68"+H
I$(TP)
HP 1640 NEXT TP
JQ 1650 PRINT#4,CHR$(14) "
{39 T}"CHR$(15)
MJ 1660 PQ=1:GOTO 1920
FJ 1670 PRINT#4,"":PRINT#4,""
HK 1680 OO=LEN(DL$):SS=40-OO:S
D=.5*SS
QJ 1690 PRINT#4,CHR$(14) ""SPC(
SD)""DL$
EX 1700 CLOSE 4
HF 1710 GOTO 20
FC 1720 OPEN4,4
HE 1730 GH$=CHR$(14)
JH 1740 PRINT#4,"":PRINT#4,"":
PRINT#4,CHR$(14) "
{10 SPACES}SPORT CARD
{SPACE}COLLECTOR"
SG 1750 PRINT#4,CHR$(14) "
{39 T}"CHR$(15)
XX 1760 PRINT#4,CHR$(14)"C# CA
RD-NAME{2 SPACES}#/CAR
DS{2 SPACES}LO
{2 SPACES}HI{2 SPACES}
"CHR$(15)
EC 1770 FOR TP=1TOYT
CP 1780 PRINT#4,CHR$(16)"01"+S
TR$(TP);
DQ 1790 PRINT#4,CHR$(16)"08"+C
M$(TP);
CH 1800 M=VAL(MT$(TP)):N=VAL(N

```



```

MS(TP)):E=VAL(GD$(TP))
:F=VAL(FP$(TP))
ED 1810 TH=M+N+E+F
HJ 1820 PRINT#4,CHR$(16)"36"+S
TR$(TH);
EC 1830 PRINT#4,CHR$(16)"46"+L
O$(TP);
RJ 1840 PRINT#4,CHR$(16)"54"+H
I$(TP)
RG 1850 NEXT TP
AK 1860 PRINT#4,CHR$(14)"
{39 T}"CHR$(15)
CM 1870 PS=2:GOTO 1920
JC 1880 REM EVAL SET WORTH
PF 1890 IF XW$="***NONE***"THEN
{SPACE}PRINT"NO FILE!
{SPACE}[HIT ANY KEY]"
MR 1900 IF XW$="***NONE***"GOTO
{SPACE}2570
QA 1910 PS=1:PQ=0
FA 1920 IF GC=1 THEN 2140
FP 1930 PRINT"{CLR}{8}EVALUATI
NG SET WORTH:"YT" ITEM
S."
DK 1940 PRINT"SCANNING RECORD
{SPACE}NUMBER:{WHT} 1"
MB 1950 HS=0:LS=0
KB 1960 FOR T=1 TO YT
JK 1970 PRINT"{HOME}{DOWN}
{23 RIGHT}"T
GC 1980 M=VAL(MT$(T)):N=VAL(NM
$(T)):E=VAL(GD$(T)):P=
VAL(FP$(T)):LP=VAL(LO$(
T))
SK 1990 HP=VAL(HI$(T))
XA 2000 IF PS<2 THEN LV=((M+(
.75*N)+(1.60*E)+(1.10*G)
)*LP)
SK 2010 IF PS=2 THEN LV=((M+N+
E+P)*LP)
FR 2020 IF PS<2 THEN HV=((M+(
.75*N)+(1.60*E)+(1.10*P)
)*HP)
ED 2030 IF PS=2 THEN HV=((M+N+
E+P)*HP)
PX 2040 HS=HS+HV:LS=LS+LV
GA 2050 NEXT T
KA 2060 PRINT"{5}LOW SET VALUE
"LS
XR 2070 IF PQ=1 OR PS=2 THEN P
RINT#4,"SET - LOW VALU
E"LS
AD 2080 PRINT"HIGH SET VALUE"HS
SS 2090 IF PQ=1 OR PS=2 THEN P
RINT#4,"SET - HIGH VAL
UE"HS
MH 2100 IF PS=2 OR PQ=1 GOTO 1
670
CS 2110 PRINT"PRESS ANY KEY"
ER 2120 GET HH$:IF HH$=""THEN
{SPACE}2120
HX 2130 GOTO 20
PM 2140 GOTO 1930
SS 2150 REM CLEAR DATA
FD 2160 PRINT"[RVS]ARE YOU POS
ITIVE [Y/N]{OFF}"
SB 2170 GET QW$:IF QW$="" THEN

```

```

2170
GF 2180 IF QW$="N" THEN 20
HF 2190 RUN
FP 2200 REM VIEW CARDS
KP 2210 PRINT"{CLR}"
CC 2220 PRINT:PRINT"{8}SET: "F
$:PRINT"CARD NUMBER? [
0 TO EXIT]"
QS 2230 PRINT"THESE ARE"YT"CAR
DS IN THE SET.{WHT}"
MD 2240 POKE19,65:INPUT CD$:CD
=VAL(CD$)
DF 2250 IF CD=0 THEN 20
EP 2260 IF CD>YT THEN 2220
XH 2270 PRINT"{CLR}":PRINT"{8}
PLAYER'S NAME: "CM$(CD
)
RG 2280 PRINT"CARDS IN MT:
{2 SPACES}"MT$(CD)
HF 2290 PRINT"CARDS IN NM:
{2 SPACES}"NM$(CD)
AK 2300 PRINT"CARDS IN EG:
{2 SPACES}"GD$(CD)
MJ 2310 PRINT"CARDS IN FP:
{2 SPACES}"FP$(CD)
MR 2320 PRINT"LOW PRICE:
{4 SPACES}"LO$(CD)
RX 2330 PRINT"HIGH PRICE:
{3 SPACES}"HI$(CD)
GG 2340 PRINT:GOTO 2220
RC 2350 F$=SY$+SN$:OPEN 15,8,1
5:PRINT#15,"S0:"F$+"
,S":CLOSE15:RETURN
HD 2360 REM DIM SUBROUTINE
PF 2370 IF YT<=0 THEN PRINT"
{8}ERROR! PRESS ANY KE
Y"
EP 2380 IF YT<=0 THEN GET XH$
SH 2390 IF YT<=0 AND XH$="" TH
EN 2380
JA 2400 IF YT<=0 THEN 20
ED 2410 DIM CM$(YT)
AK 2420 DIM MT$(YT)
MM 2430 DIM NM$(YT)
SC 2440 DIM GD$(YT)
RF 2450 DIM FP$(YT)
BK 2460 DIM LO$(YT)
ME 2470 DIM HI$(YT)
FR 2480 RETURN
CG 2490 PRINT"{CLR}{8}SETTING
{SPACE}UP FILE -"YT"RE
CORDS"
QP 2500 PRINT"ON RECORD NUMBER
: {WHT}1"
MQ 2510 FOR TQ=1 TO YT
AK 2520 CM$(TQ)="0":MT$(TQ)="0
":NM$(TQ)="0":GD$(TQ)="
0"
CH 2530 FP$(TQ)="0":LO$(TQ)="0
":HI$(TQ)="0"
HD 2540 PRINT"{HOME}{DOWN}
{17 RIGHT}"TQ
BC 2550 NEXT TQ
CA 2560 RETURN
SG 2570 GET XL$:IF XL$="" THEN
2570
QM 2580 GOTO 20

```

Kevin Scott Davis is an honor student in high school and has a card collection of more than 2000 basketball players. He lives in Winter Park, Florida. □

FILE COPIER

By Daniel Lightner

Use this disk utility program to copy single files or groups of files and to perform other functions as well. *File Copier* loads the disk directory into memory and lets you freely thumb through its contents, tagging as many files as you like.

For example, you can copy these tagged files to another disk, scratch them, or rename them. *File Copier* performs other operations as well, such as formatting or validating a disk.

File Copier is written entirely in machine language. To type it in, use *MLX*, our machine language entry program; see "Typing Aids" elsewhere in this section. When prompted for starting and ending addresses, respond with the following values.

Starting address: 0801

Ending address: 1458

Be sure to save a copy of *File Copier* before you exit *MLX*.

Getting Started

File Copier loads and runs like a BASIC program. After *File Copier* has been started, it deletes 684 bytes, about three disk blocks, from the end of itself. This is where *File Copier* starts loading the files you select.

File Copier can load up to 48,722 bytes or 191 disk blocks at a time. When this memory is filled, the program will instruct you to place the target disk (the disk you want these files copied to) in drive 8 for saving.

When it has finished saving this first block of memory and you have selected more files, *File Copier* will instruct you to put the source disk back in the drive to continue the copying process.

First Things First

When you first run *File Copier*, it attempts to load the directory of any disk in drive 8. If you wish to format a disk, do not place it in the drive until af-

ter *File Copier* has read a disk directory, perhaps the one that you loaded *File Copier* from. After it has read the directory, if you wish to format a disk, then place the unformatted disk in the drive and choose the format option.

Menu Selections

When *File Copier* runs, all of its functions are listed on the screen, as shown below. Make selections by pressing the appropriate function key.

- f1—VALIDATE DISK
- f2—SCRATCH
- f3—RENAME
- f4—FORMAT
- f5—DIRECTORY
- f6—QUIT
- f7—COPY
- f8—ABORT

You will see the greater-than sign (>) on the lower left portion of the screen. This pointer is where all information will be displayed during operation.

To select files after *File Copier* has loaded the directory, use the Crsr Up/Down keys to scroll up and down the directory listing. When you see a file you wish to select, press the Return key. Notice that the filename is now followed by an arrow. This arrow is to indicate that this file has been selected. If you change your mind about your selection, you may press the Return key again to toggle the selection off again.

After you have made your selections, choose the desired function key. If you find that you have made the wrong choice, use the f8 key to abort that selection. Abort the selection only when *File Copier* is showing the option name and the Press Key prompt. If you press any other key, the program will activate the indicated function. So be careful; you could accidentally delete files that you intended to copy. If you only want to copy files, it is best to put a write-protect tab on your source disk.

When you choose the Format option, *File Copier* asks you to provide a name for the disk you are formatting; then it asks for an ID. This is a two-step process, so do not provide the ID when you enter a disk name.

To rename selected files, just follow the onscreen prompts. *File Copier* first shows you the current selection and

prompts for a keypress. It then asks for the desired new name. Enter the new name and press Return.

If you select the Scratch option, *File Copier* will delete all marked files unless you decide to abort the process at the Press Key prompt. So be sure that the files you have picked are ones that you really don't need.

The remaining functions are self-explanatory. *File Copier* keeps you informed with various onscreen messages while all selected functions are being carried out.

FILE COPIER

```
0801:1E 08 0A 00 9E 32 30 38 B9
0809:38 20 3A 20 46 49 4C 45 BB
0811:20 43 4F 50 49 45 52 20 15
0819:27 39 31 27 00 00 00 00 A3
0821:00 00 00 00 00 00 00 20 51
0829:CC FF D8 A9 00 8D 21 D0 9E
0831:A9 05 8D 20 D0 AD 0E DC 41
0839:29 FE 8D 0E DC A5 01 29 D8
0841:FE 85 01 AD 0E DC 09 01 24
0849:8D 0E DC A9 C1 8D 18 03 51
0851:A9 34 8D 14 03 20 B7 11 4F
0859:20 94 0D 20 B9 0D 20 87 0C
0861:10 20 FE 09 20 46 0A 20 40
0869:31 0B A9 00 8D A5 03 8D A0
0871:A8 02 8D C3 02 A9 01 8D 8A
0879:A2 03 20 07 0A 20 6F 09 C8
0881:20 E4 FF C9 11 F0 27 C9 DB
0889:91 F0 29 C9 0D F0 68 C9 27
0891:89 F0 27 C9 87 F0 2C C9 46
0899:8A F0 2B C9 85 F0 2D C9 41
08A1:8B F0 38 C9 86 F0 2B C9 6F
08A9:88 F0 43 4C 81 08 20 21 F4
08B1:0A 4C 7B 08 20 34 0A 4C FB
08B9:7B 08 20 12 09 20 7C 0B 7B
08C1:4C 59 08 4C 62 08 20 E8 70
08C9:0B 4C 59 08 20 64 0C 4C 15
08D1:59 08 20 12 09 20 AA 0C DF
08D9:4C 59 08 20 07 0A 20 E6 F0
08E1:0D 20 B9 0D 20 87 10 C9 91
08E9:8C F0 E4 4C E2 FC 20 12 3B
08F1:09 20 9D 0E 4C 59 08 AC A7
08F9:A2 03 B9 01 70 C9 00 F0 FE
0901:08 A9 00 99 01 70 4C 7B F8
0909:08 A9 01 99 01 70 4C 7B 21
0911:08 20 FE 09 A0 00 8C FF BD
0919:02 A9 01 8D A8 02 EE 00 BA
0921:70 B9 01 70 C9 01 F0 0C 41
0929:C8 CC 00 70 D0 F3 A9 00 83
0931:8D A8 02 60 8C FA 03 8C 5D
0939:A2 03 20 07 0A 20 6F 09 8A
0941:20 4A 09 AC FA 03 4C 29 87
0949:09 A0 00 A2 00 BD 35 03 96
0951:91 FD E8 20 EC 0A EC 34 68
0959:03 D0 F2 A9 00 91 FD 20 7C
0961:EC 0A 91 FD 20 EC 0A EE 36
0969:FF 02 60 4C 70 0B AD A0 98
0971:03 C9 00 F0 F6 A9 01 8D 74
0979:A5 03 20 BD 0A A0 00 AD 7F
0981:A5 03 CD A2 03 F0 1E B1 D4
0989:FB C9 2C F0 06 20 DE 0A 19
```

```
0991:4C 88 09 20 DE 0A 20 DE 4D
0999:0A 18 AD A5 03 69 01 8D 14
09A1:A5 03 4C 80 09 A9 00 8D 55
09A9:34 03 A2 00 B1 FB C9 2C 28
09B1:F0 10 20 F0 09 9D 35 03 7F
09B9:E8 EE 34 03 20 DE 0A 4C 8F
09C1:AD 09 9D 35 03 EE 34 03 33
09C9:20 F0 09 E8 20 DE 0A B1 1A
09D1:FB 9D 35 03 EE 34 03 20 8E
09D9:F0 09 AC A2 03 B9 01 70 D7
09E1:C9 01 F0 01 60 A9 20 20 51
09E9:F0 09 A9 5F 4C F0 09 48 62
09F1:AD A8 02 C9 01 F0 04 68 1E
09F9:4C D2 FF 68 60 A9 B7 85 0C
0A01:FD A9 11 85 FE 60 20 16 C8
0A09:0A A2 00 A9 20 20 D2 FF 8C
0A11:E8 E0 26 D0 F6 A9 13 85 AD
0A19:D6 A9 02 85 D3 4C 6C E5 2A
0A21:AD A2 03 CD A0 03 90 01 25
0A29:60 18 AD A2 03 69 01 8D A0
0A31:A2 03 60 AD A2 03 C9 02 F4
0A39:B0 01 60 38 AD A2 03 E9 5D
0A41:01 8D A2 03 60 A0 00 A9 EC
0A49:00 A9 01 A2 B6 A0 11 20 8C
0A51:BD FF A9 02 A2 08 A0 00 10
0A59:20 BA FF 20 C0 FF 20 97 0C
0A61:0D C0 0E B0 3C A2 02 20 89
0A69:C6 FF A9 9A 20 D2 FF A0 AC
0A71:00 8C B1 02 20 BD A0 A9 B4
0A79:01 8D B3 02 20 E4 FF 20 BC
0A81:E4 FF 20 E4 FF 8D B0 02 F3
0A89:20 E4 FF 0D B0 02 F0 1C 43
0A91:20 E4 FF 20 E4 FF 20 E4 3D
0A99:FF F0 E7 20 C6 0A 4C 97 77
0AA1:00 20 B9 0D A2 00 20 C6 E6
0AA9:FF 20 87 10 A9 00 A0 00 46
0AB1:91 FB A2 00 20 C6 FF A9 A7
0AB9:02 4C C3 FF A9 00 85 FB AE
0AC1:A9 C0 85 FC 60 C9 22 F0 BA
0AC9:30 AA AD B3 02 C9 01 F0 BB
0AD1:19 AD B1 02 C9 01 D0 12 3A
0AD9:8A A0 00 91 FB 18 A5 FB FB
0AE1:69 01 85 FB A5 FC 69 00 4F
0AE9:85 FC 60 18 A5 FD 69 01 86
0AF1:85 FD A5 FE 69 00 85 FE 42
0AF9:60 AD B1 02 C9 01 F0 06 3A
0B01:A9 01 8D B1 02 06 A9 00 DD
0B09:8D B1 02 AD B3 02 C9 01 A7
0B11:F0 18 A9 2C A0 00 91 FB C1
0B19:20 DE 0A 20 E4 FF C9 20 15
0B21:F0 F9 A0 00 91 FB 4C DE 36
0B29:0A 60 A9 00 8D B3 02 60 31
0B31:20 BD 0A A0 00 A9 00 8D 46
0B39:A0 03 B1 FB C9 00 F0 1C A2
0B41:C9 2C F0 06 20 DE 0A 4C A2
0B49:3B 0B 20 DE 0A 18 AD A0 5E
0B51:03 69 01 8D A0 03 20 DE 6C
0B59:0A 4C 3B 0B AD A0 03 8D 23
0B61:00 70 A0 00 A9 00 99 01 29
0B69:70 CC A0 03 F0 04 C8 4C A4
0B71:65 0B 60 20 07 0A A2 08 B8
0B79:4C 06 0E 20 07 0A 20 BE 5A
0B81:0D 20 B9 0D 20 87 10 C9 37
0B89:8C F0 59 AD FF 02 C9 00 C3
0B91:F0 52 A9 01 8D BD 02 20 81
0B99:FE 09 20 2B F0 20 07 0A 39
0BA1:20 BE 0D 20 F0 0D 20 64 7B
0BA9:0D A0 00 B9 F0 10 99 48 4D
0BB1:03 C8 C0 03 D0 F5 CE 34 F3
0BB9:03 CE 34 03 A0 00 B9 35 69
```


00BC1:03	99	4B	03	C8	CC	34	03	3E	00DF1:0E	4C	06	0E	A2	0C	4C	06	AB	1021:A9	01	8D	FC	03	20	61	10	43	
00BC9:D0	F4	18	AD	34	03	69	03	E6	00DF9:0E	A2	10	4C	06	0E	A2	0D	4F	1029:20	97	0D	C0	0E	B0	BC	20	B9	
00BD1:8D	34	03	20	76	0D	AD	BD	1F	00E01:4C	06	0E	A2	0F	A9	F4	85	3F	1031:07	A0	20	FF	0D	20	64	0D	1A	
00BD9:02	CD	FF	02	F0	06	EE	BD	BF	00E09:30	A9	10	85	31	A0	00	18	26	1039:A2	02	20	C9	FF	A0	00	B1	FF	
00BE1:02	4C	98	0B	4C	94	0D	20	BE	00E11:A5	30	7D	A5	11	85	30	A5	BA	1041:FB	20	D2	FF	20	DE	0A	20	72	
00BE9:07	0A	20	D2	0D	20	B9	0D	A0	00E19:31	69	00	85	31	E0	00	F0	7E	1049:04	10	AD	BA	02	CD	BE	02	97	
00BF1:20	87	10	C9	8C	F0	6B	20	B7	00E21:04	CA	4C	10	0E	B1	30	C9	DD	1051:F0	03	4C	40	10	AD	BB	02	E8	
00BF9:07	0A	20	C8	0D	20	34	0E	06	00E29:2A	F0	07	20	D2	FF	C8	4C	ED	1059:CD	BF	02	D0	E2	4C	D5	0F	A0	
00C01:A0	00	B9	E4	10	99	48	03	69	00E31:26	0E	60	A0	00	A9	00	8D	2E	1061:20	CC	FF	AD	34	03	A2	35	C7	
00C09:C8	C0	03	D0	F5	A0	00	B9	0F	00E39:34	03	20	E4	FF	C9	00	F0	9A	1069:A0	03	20	BD	FF	A9	02	A2	C7	
00C11:35	03	99	4B	03	C8	CC	34	75	00E41:F9	C9	14	F0	3E	C9	7B	B0	1F	1071:08	AC	FC	03	20	BA	FF	20	9C	
00C19:03	D0	F4	AD	34	03	85	FB	15	00E49:F1	C9	11	F0	ED	C9	13	F0	AF	1079:C0	FF	A9	00	8D	BA	02	8D	10	
00C21:20	07	0A	20	CD	0D	20	34	65	00E51:E9	C9	1D	F0	E5	C9	22	F0	13	1081:BB	02	8D	C3	02	60	20	E4	AA	
00C29:0E	A6	FB	A9	2C	9D	4B	03	7D	00E59:E1	C9	2C	F0	ED	C9	0D	F0	8E	1089:FF	C9	00	F0	F0	60	20	07	C3	
00C31:E8	A0	00	B9	35	03	9D	4B	BD	00E61:10	AC	34	03	C0	10	F0	D2	62	1091:0A	20	04	0E	20	B9	0D	20	42	
00C39:03	E8	C8	C0	03	D0	F4	18	8F	00E69:20	D2	FF	20	7A	0E	4C	3B	2C	1099:87	10	C9	8C	FA	09	AD	E0	2C	
00C41:8A	69	03	8D	34	03	20	07	27	00E71:0E	AC	34	03	C0	00	F0	C2	21	10A1:02	8D	BD	AD	02	AD	C9	02	85	1C
00C49:0A	20	04	0E	20	B9	0D	20	F1	00E79:60	AC	34	03	99	35	03	EE	3E	10A9:FB	AD	CA	02	85	FC	20	FE	0C	
00C51:87	10	C9	8C	F0	0C	20	07	32	00E81:34	03	60	AC	34	03	C0	01	7F	10B1:09	20	2B	0F	AE	34	03	A9	AA	
00C59:0A	20	D2	0D	20	F0	0D	4C	D4	00E89:B0	03	4C	3B	0E	20	D2	FF	92	10B9:2C	9D	35	03	E8	A9	57	9D	68	
00C61:76	0D	60	20	07	0A	20	D7	7E	00E91:38	AD	34	03															


```

1251:C9 20 1C 20 DD 0D 1D 1C 61
1259:12 DD 20 9E DD 20 20 20 BB
1261:DD 20 DD 20 DD CA CB DD C9
1269:20 AB C0 CB 20 DD 20 DD F3
1271:20 20 DD 20 20 AB C0 20 BC
1279:20 20 CA C0 C9 20 1C 20 42
1281:DD 0D 1D 1C 12 DD 20 9E 24
1289:CA C0 CB 20 CA C0 CB 20 CF
1291:BD 20 20 AD 20 B1 20 20 A3
1299:20 CA C0 CB 20 20 B1 20 5A
12A1:20 B1 C0 BD 20 20 CA C0 0E
12A9:CB 20 1C 20 DD 0D 1D 1C BA
12B1:12 DD 20 20 20 20 20 20 3E
12B9:20 20 20 20 20 20 20 DD
12C1:20 20 20 20 20 20 20 E5
12C9:20 20 20 20 20 20 20 ED
12D1:20 20 20 20 20 20 DD 5E
12D9:1D 1C 12 CA C0 C0 C0 C0 CD
12E1:C0 C0 C0 C0 C0 C0 C0 06
12E9:C0 C0 C0 C0 C0 C0 C0 0E
12F1:C0 C0 C0 C0 C0 C0 C0 16
12F9:C0 C0 C0 C0 C0 C0 C0 1E
1301:CB 0D 11 9A 1D 1D 1D 1D D0
1309:20 B2 AE 20 B2 20 20 B2 CC
1311:20 20 B2 AE 20 20 20 B2 05
1319:AE 20 B0 AE 20 B2 AE 20 E8
1321:B2 20 B2 AE 20 B2 AE 20 D0
1329:1D 1D 1D 1D 20 AB 20 AA
1331:DD A0 20 DD 20 20 AB 20 49
1339:20 20 20 DD 20 20 DD DD 74
1341:20 AB BD 20 DD 20 AB 20 03
1349:20 AB B3 0D 1D 1D 1D 1D 66
1351:20 B1 20 20 B1 20 20 B1 F9
1359:BD 20 B1 BD 20 20 B1 EB
1361:BD 20 AD BD 20 B1 20 20 28
1369:B1 20 B1 BD 20 B1 AD 0D B2
1371:11 96 1D 1D 1D 1D 1D 1D EF
1379:1D 1D 1D 1D 1D 1D 1D 43 C5
1381:4F 50 59 52 49 47 48 54 FF
1389:20 31 39 39 31 0D 11 96 3D
1391:1D 1D 1D 1D 1D 1D 43 4F 36
1399:4D 50 55 54 45 20 50 55 0B
13A1:42 4C 49 43 41 54 49 4F 96
13A9:4E 53 20 49 4E 54 4C 20 E0
13B1:4C 54 44 11 0D 1D 1D 1D E0
13B9:1D 1D 1D 1D 1D 1D 41 04
13C1:4C 4C 20 52 49 47 48 54 96
13C9:53 20 52 45 53 45 52 56 EA
13D1:45 44 11 0D 1C 3E 11 1F B9
13D9:0D 1D 1C 46 31 2D 1F 20 52
13E1:56 41 4C 49 44 41 54 45 B6
13E9:20 20 1C 46 32 2D 20 1F B5
13F1:53 43 52 41 54 43 48 20 51
13F9:20 1C 46 33 2D 20 1F 52 AD
1401:45 4E 41 4D 45 0D 1D 12
1409:1D 1D 1C 46 34 2D 20 1F A4
1411:46 4F 52 4D 41 54 20 20 0B
1419:20 1C 46 35 2D 20 1F 4C E8
1421:4F 41 44 20 44 49 52 45 FC
1429:43 54 4F 52 59 0D 1D 1D 6D
1431:1D 1D 1D 1C 46 36 2D 20 1A
1439:1F 51 55 49 54 20 20 1C 04
1441:46 37 2D 20 1F 43 4F 50 F6
1449:59 20 20 1C 46 38 2D 20 79
1451:1F 41 42 4F 52 54 0D 00 94

```

PUZZLE MANIA

By Maurice Yanney

As different pieces fall from the sky in *Puzzle Mania*, it's your job to see that they land on identically shaped pieces on rows at the bottom of the screen. You control the position of the lower shapes, but lining them up with the falling pieces can be tricky.

Completing a puzzle and continuing to the next level require matching all the pieces on each of the three rows at the bottom of the puzzle. *Puzzle Mania* is a one-player game which requires fast reactions and quick thinking.

Getting Started

Although *Puzzle Mania* is written in machine language, it loads and runs like a BASIC program. To type it in, use *MLX*, our machine language entry program. When *MLX* prompts you, respond with the values given below.

Starting address: 0801

Ending address: 12E0

Be sure to save a copy of the program before exiting *MLX*. Movement is controlled by using a joystick (in either port) or the keyboard.

Playing the Game

As pieces fall, you try to see to it that they land on matching pieces before time expires. Complete one level, and then proceed to the next. Each level contains a more difficult puzzle.

The first level consists of the falling pieces and three bottom rows. An additional row is added on subsequent levels. Each row consists of five shapes to be matched. When a piece is matched by a falling piece, it disappears from the row. When all the pieces have been matched, you move to the next level.

You position the shapes on the bottom rows with a joystick (in either port) or by using the I, J, K, and M keys to move up, left, right, and down, respectively. When you move up, the top row of the puzzle becomes the bottom row, and all the other rows move up one row. Moving down does the opposite; the bottom row becomes the top row, and all the other rows move down one row. Moving left and right affects only

the top row by moving the shapes left or right. If you move a shape off one side of the screen, it will wrap to the other side. Moving 39 positions to the left is the same as moving one position to the right, except that it takes longer.

Pieces fall three at a time, and there are eight different pieces in all. Each piece has a unique match. If a falling piece is not met by its match, then a different shape takes its place. If the falling piece matches, that piece disappears, and you receive 100 points. Then a new piece starts to fall.

The time given to complete the first level is 500 ticks. An onscreen clock shows ticks remaining. An additional 100 ticks are given to complete subsequent levels until level 6, and then no additional time is awarded. When all the pieces are matched and a level is completed, bonus points are awarded based on the amount of time remaining. Ten bonus points are given for each remaining tick.

To pause the game, hold down the Shift key (or press the Shift Lock key). When the Shift key (or Shift Lock key) is released, the game continues.

Tips on Playing

The puzzle pieces fall slowly in the first few levels, so utilize this time to your advantage. Instead of just lining up one piece and waiting for it to fall into place, plan a move or two ahead. One way of doing this is to line up the second falling piece with its match on the second or third bottom row. Once the first piece is matched, move up or down until the row with the prealigned piece is on top. You can then get pieces that are going to reach the top row at nearly the same time. On higher levels you'll need to do this often.

Another tip useful on higher levels involves putting a priority on which piece you're trying to match. There are eight different pieces. Although the pieces fall in a somewhat random order, all eight pieces will fall before a new sequence starts. If one piece appears many times on the puzzle board and another only a few times, you should try to match the ones appearing more frequently. You may have only a couple of pieces remaining, don't waste time waiting for the the same one or two pieces to reappear.

Daniel Lightner is a frequent contributor. He lives in Sidney, Montana. □

PUZZLE MANIA

0801:0B 0B 0A 00 9E 20 32 30 A4
 0809:36 32 00 00 00 A9 0C 8D 0D
 0811:20 D0 A9 0F 8D 21 D0 20 3E
 0819:95 10 20 D9 11 20 CB 08 42
 0821:20 A9 12 20 03 0D 20 D9 56
 0829:11 20 8B 12 20 72 0F AD F2
 0831:8D 02 C9 01 F0 F9 20 F7 79
 0839:0C AD E6 12 18 69 01 8D AE
 0841:E6 12 F0 0B C9 FA F0 12 46
 0849:C9 FD F0 0E 4C 30 08 20 10
 0851:16 10 20 EA 0B A9 F7 8D 9F
 0859:E6 12 A5 C5 C9 25 F0 35 6C
 0861:C9 22 F0 37 C9 21 F0 39 5E
 0869:C9 24 F0 3B AD 00 DC C9 2A
 0871:77 F0 22 C9 7B F0 24 C9 0C
 0879:7E F0 26 C9 7D F0 28 AD 14
 0881:01 DC C9 F7 F0 F0 C9 FB 55
 0889:F0 11 C9 FE F0 13 C9 FD E4
 0891:F0 15 4C AE 08 20 B4 0D 0B
 0899:4C AE 08 20 CA 0D 4C AE 50
 08A1:08 20 63 0D 4C AE 08 20 48
 08A9:F7 0D 4C AE 08 20 CB 0A CF
 08B1:AD F5 12 D0 03 20 3A 0C 7E
 08B9:AD DB 12 C9 FF F0 08 A9 F3
 08C1:01 20 2F 0B 4C 30 08 4C 70
 08C9:AB 09 20 22 12 A0 00 A9 D4
 08D1:FF 99 D0 66 C8 C0 C8 D0 6E
 08D9:F8 A2 13 A0 02 18 20 0A 36
 08E1:E5 A9 51 A0 09 20 1E AB 34
 08E9:A2 15 20 7D 12 A9 01 8D 33
 08F1:DF 12 A2 00 AD DF 12 38 14
 08F9:E9 01 C9 FF D0 02 A9 0C 66
 0901:8D DF 12 A8 B9 9E 09 9D 96
 0909:00 04 9D B4 04 9D 68 05 87
 0911:9D 1C 06 AD DF 12 29 07 35
 0919:0A 9D 00 D8 9D B4 D8 9D 34
 0921:68 D9 9D 1C DA C8 C0 D0 DB
 0929:D0 02 A0 00 E8 E0 B4 F0 5D
 0931:03 4C 05 09 A2 00 AD 00 79
 0939:DC C9 7F D0 12 AD 01 DC 4F
 0941:C9 FF D0 0B 20 F7 0C E8 E4
 0949:E0 03 D0 EA 4C F3 08 60 F7
 0951:96 54 4F 20 4D 4F 56 45 49
 0959:3A 20 20 4A 4F 59 53 54 14
 0961:49 43 4B 20 4F 52 20 49 A1
 0969:2C 4A 2C 4B 20 26 20 4D 85
 0971:20 4B 45 59 53 00 96 4D B9
 0979:4F 56 45 20 4A 4F 59 53 09
 0981:54 49 43 4B 20 4F 52 20 30
 0989:50 52 45 53 53 20 53 50 48
 0991:41 43 45 20 54 4F 20 53 33
 0999:54 41 52 54 00 10 15 1A 3A
 09A1:1A 0C 05 20 0D 01 0E 09 F7
 09A9:01 20 20 2F 0B A2 01 A0 C0
 09B1:0F 18 20 0A E5 A9 F6 A0 5A
 09B9:09 20 1E AB A2 C8 20 F7 47
 09C1:0C E8 D0 FA A2 03 20 7D BC
 09C9:12 A2 05 A0 0F 18 20 0A 5B
 09D1:E5 A9 01 A0 0A 20 1E AB 24
 09D9:AD 00 DC C9 7F F0 03 4C 0D
 09E1:21 08 AD 01 DC C9 FF F0 4B
 09E9:03 4C 21 08 A5 C5 C9 27 34
 09F1:D0 E6 20 E2 FC 96 47 41 6A
 09F9:4D 45 20 4F 56 45 52 00 69
 0A01:96 4E 20 54 4F 20 51 55 30
 0A09:49 54 00 AC F7 12 B9 EC 0A
 0A11:12 85 FB B9 ED 12 85 FC 6A
 0A19:A0 00 B1 FB C9 20 F0 7D A1

0A21:C9 FF F0 76 C9 EF B0 75 84
 0A29:AC F6 12 B9 F2 12 18 69 A8
 0A31:01 29 FE AA A0 00 B1 FB FE
 0A39:A8 C0 EE D0 07 E0 FE D0 47
 0A41:59 4C 8F 0A C0 ED D0 07 0E
 0A49:E0 FC D0 4E 4C 8F 0A C0 81
 0A51:EC D0 07 E0 FA D0 43 4C EC
 0A59:8F 0A C0 EB D0 07 E0 F8 EB
 0A61:D0 38 4C 8F 0A C0 EA D0 68
 0A69:07 E0 F6 D0 2D 4C 8F 0A E8
 0A71:C0 E9 D0 07 E0 F4 D0 22 89
 0A79:4C 8F 0A C0 E8 D0 07 E0 5E
 0A81:F2 D0 17 4C 8F 0A C0 E7 F8
 0A89:D0 10 E0 F0 D0 C0 20 9F CB
 0A91:0A AD F5 12 38 E9 01 8D EE
 0A99:F5 12 20 6D 0B 60 A0 00 23
 0AA1:A9 FF 91 FB 20 3B D0 A0 25
 0AA9:02 A9 00 91 FB AD DF 12 AA
 0AB1:85 FD AD E0 12 85 FE 88 F8
 0AB9:88 B1 FD C8 C8 C8 91 FB 53
 0AC1:C0 2A D0 F3 A9 0A 20 03 D2
 0AC9:10 60 A9 00 8D F6 12 8D 2D
 0AD1:F7 12 20 0C 0A A9 01 8D B1
 0AD9:F6 12 A9 02 8D F7 12 20 D3
 0AE1:0C 0A A9 02 8D F6 12 A9 E9
 0AE9:04 8D F7 12 20 0C 0A 60 29
 0AF1:AC F6 12 B9 F8 12 49 01 9B
 0AF9:99 F8 12 D0 03 20 BE 0B 89
 0B01:00 A9 C8 8D DA 12 A9 00 16
 0B09:8D DB 12 AC E3 12 C0 07 D9
 0B11:90 02 A0 07 AD DA 12 18 89
 0B19:69 64 8D DA 12 AD DB 12 6D
 0B21:69 00 8D DB 12 88 C0 FF 8F
 0B29:D0 EA 20 4E 0F 60 8D E1 42
 0B31:12 A2 00 A0 00 B9 E9 12 CF
 0B39:D0 2A BD EC 12 85 FB E8 50
 0B41:BD EC 12 85 FC 98 8D DF 51
 0B49:12 AD E1 12 F0 0A B9 F2 47
 0B51:12 38 F9 F8 12 4C 5B 0B D0
 0B59:A9 20 A0 00 91 FB AC DF 16
 0B61:12 4C 66 0B E8 E8 C8 C0 4E
 0B69:03 D0 CA 60 20 97 E0 A5 5B
 0B71:8F 29 0F 69 01 AC F6 12 CC
 0B79:99 E9 12 20 CA 0E 0A 69 27
 0B81:F0 AC F6 12 99 F2 12 20 18
 0B89:97 E0 A5 8F AC F6 12 C0 77
 0B91:00 F0 14 C0 01 F0 08 29 77
 0B99:0F 18 69 18 4C AA 0B 29 3B
 0BA1:07 18 69 10 4C AA 0B 29 38
 0BA9:0F AC F7 12 99 EC 12 A9 E0
 0BB1:04 99 ED 12 A9 01 AC F6 B0
 0BB9:12 99 F8 12 60 AC F7 12 37
 0BC1:B9 EC 12 85 FB B9 ED 12 3F
 0BC9:85 FC 98 8D DF 12 A0 00 56
 0BD1:A9 20 91 FB AC DF 12 B9 79
 0BD9:EC 12 18 69 28 99 EC 12 18
 0BE1:B9 ED 12 69 00 99 ED 12 7D
 0BE9:60 AD E9 12 F0 09 38 E9 FF
 0BF1:01 8D E9 12 4C 03 0C A9 7A
 0BF9:00 8D F6 12 8D F7 12 20 04
 0C01:F1 0A AD EA 12 F0 09 38 97
 0C09:E9 01 8D EA 12 4C 1E 0C C0
 0C11:A9 01 8D F6 12 A9 02 8D 28
 0C19:F7 12 20 F1 0A AD EB 12 C5
 0C21:F0 09 38 E9 01 8D EB 12 C1
 0C29:4C 39 0C A9 02 8D F6 12 18
 0C31:A9 04 8D F7 12 20 F1 0A 4F
 0C39:60 A9 00 20 2F 0B 18 AD 71
 0C41:E2 12 69 01 C9 0D D0 02 B2
 0C49:A9 0C 8D E2 12 8D E3 12 B9

0C51:A9 0F 8D F5 12 AE E2 12 36
 0C59:AD F5 12 18 69 05 8D F5 F9
 0C61:12 CA E0 02 D0 F2 A2 06 0F
 0C69:A0 0D 18 20 0A E5 A9 E3 39
 0C71:A0 0C 20 1E AB A2 06 A0 57
 0C79:1A 18 20 0A E5 A9 00 AE CD
 0C81:DC 12 20 CD BD A2 08 A0 96
 0C89:0F 18 20 0A E5 A9 F0 A0 2C
 0C91:0C 20 1E AB A9 00 8D E7 86
 0C99:12 8D E8 12 18 AD E7 12 B5
 0CA1:69 0A 8D E7 12 AD E8 12 4C
 0CA9:69 00 8D E8 12 A2 08 A0 82
 0CB1:16 18 20 0A E5 AD E8 12 49
 0CB9:AE E7 12 20 CD BD A9 01 21
 0CC1:20 03 10 AD DB 12 C9 FF 42
 0CC9:F0 06 20 16 10 4C 9D 0C 3A
 0CD1:20 38 12 A2 7D 20 F7 0C DC
 0CD9:E8 D0 FA 20 8B 12 20 2B 0C
 0CE1:10 60 45 4E 44 20 4F 46 2F
 0CE9:20 4C 45 56 45 4C 00 42 D0
 0CF1:4F 4E 55 53 3A 00 A0 4B 83
 0CF9:A9 DC 69 01 D0 FC C8 D0 38
 0D01:F7 60 A2 00 A9 70 85 FD 9B
 0D09:A9 07 85 FE A9 FB 85 FE 9E
 0D11:A9 12 85 FC A0 00 A5 FD 53
 0D19:91 FB C8 A5 FE 91 FB C8 6D
 0D21:A9 02 91 FB 38 A5 FD E9 C0
 0D29:28 85 FD A5 FE E9 00 85 F7
 0D31:FE 20 9B 12 E8 E0 0D D0 1D
 0D39:DB 60 20 48 0E A9 FB 85 76
 0D41:FB A9 12 85 FC A0 00 38 01
 0D49:B1 FB ED DF 12 8D E1 12 93
 0D51:C8 B1 FB ED E0 12 0D E1 E5
 0D59:12 0F 06 20 9B 12 4C 46 7F
 0D61:0D 60 20 48 0E 20 E0 0D 62
 0D69:A0 00 38 B1 FB ED DF 12 5F
 0D71:8D E1 12 C8 B1 FB ED E0 D3
 0D79:12 0D E1 12 D0 0E A0 00 3D
 0D81:A9 70 91 FB C8 A9 07 91 0B
 0D89:FB 4C 9D 0D A0 00 38 B1 60
 0D91:FB E9 28 91 FB C8 B1 FB A4
 0D99:E0 00 91 FB 38 AD E2 12 EA
 0DA1:E9 01 8D E2 12 C9 FF D0 59
 0DA9:BC AD E3 12 8D E2 12 20 67
 0DB1:6F 0E 60 20 3B 0D A0 02 66
 0DB9:38 B1 FB E9 01 C9 FF D0 7A
 0DC1:02 A9 27 91 FB 20 91 0E D6
 0DC9:60 20 3B 0D A0 02 18 B1 43
 0DD1:FB 69 01 C9 28 D0 02 A9 33
 0DD9:00 91 FB 20 91 0E 60 AC 0C
 0DE1:E2 12 A9 FB 85 FB A9 12 68
 0DE9:85 FC C0 00 F0 07 88 20 F2
 0DF1:9B 12 4C EB 0D 60 20 E0 B1
 0DF9:0D A0 00 38 B1 FB E9 70 08
 0E01:8D E1 12 C8 B1 FB E9 07 83
 0E09:0D E1 12 D0 13 20 48 0E 2B
 0E11:A0 00 AD DF 12 91 FB C8 C8
 0E19:AD E0 12 91 FB 4C 31 0E 21
 0E21:A0 00 18 B1 FB 69 28 91 13
 0E29:FB C8 B1 FB 69 00 91 FB D5
 0E31:38 AD E2 12 E9 01 8D E2 A3
 0E39:12 C9 FF D0 B9 AD E3 12 3C
 0E41:8D E2 12 20 6F 0E 60 AC 42
 0E49:E3 12 A9 70 8D DF 12 A9 D1
 0E51:07 8D E0 12 C0 00 F0 15 8E
 0E59:88 38 AD DF 12 E9 28 8D 91
 0E61:DF 12 AD E0 12 E9 00 8D 7B
 0E69:E0 12 4C 55 0E 60 A2 00 90
 0E71:A9 FB 85 FB A9 12 85 FC 6F
 0E79:8A 8D DF 12 20 91 0E AD 6C

PROGRAMS

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0E81:DF 12 AA EC E3 12 F0 07 86
0E89:20 9B 12 E8 4C 79 0E 60 32
0E91:A2 00 A0 00 B1 FB 85 FD 99
0E99:C8 B1 FB 85 FE C8 18 B1 5B
0EA1:FB 69 03 A8 A5 FE F0 20 2C
0EA9:B1 FB 8D E0 12 98 8D E1 4D
0EB1:12 8A A8 AD E0 12 91 FD D9
0EB9:AD E1 12 A8 C8 E8 C0 2B 88
0EC1:D0 02 A0 03 E0 28 D0 E0 35
0EC9:60 AD E4 12 C9 07 D0 0F 5A
0ED1:A9 00 8D E4 12 20 97 E0 E3
0ED9:A5 8F 29 07 8D E5 12 18 82
0EE1:AD E4 12 69 01 8D E4 12 01
0EE9:18 AD E5 12 69 01 29 07 04
0EF1:8D E5 12 60 20 E0 0D A0 D5
0EF9:03 A9 00 8D E1 12 A9 FF 85
0F01:91 FB C8 C0 2B D0 F9 A0 3D
0F09:03 C8 C8 C8 C8 C8 C8 44
0F11:98 8D DF 12 20 CA 0E 18 5C
0F19:69 E7 AC DF 12 91 FB AD F5
0F21:E1 12 18 69 01 8D E1 12 62
0F29:C9 05 D0 DD 20 97 E0 29 AF
0F31:07 A0 02 91 FB 60 20 F5 EB
0F39:0E 38 AD E2 12 E9 01 8D 18
0F41:E2 12 C9 FF 00 F0 AD E3 18
0F49:12 8D E2 12 60 A2 18 A0 AF
0F51:06 AD DA 12 8D DF 12 AD 18
0F59:DB 12 8D E0 12 20 B2 0F 2F
0F61:20 38 10 18 20 0A E5 AD C3
0F69:DB 12 AE DA 12 20 CD BD E7
0F71:60 A2 18 A0 21 AD DC 12 01
0F79:8D DF 12 A9 00 8D E0 12 3D
0F81:20 B2 0F 18 20 0A E5 A9 5E
0F89:00 AE DC 12 20 CD BD 60 24
0F91:A2 18 A0 14 AD DD 12 8D F2
0F99:DF 12 AD DE 12 8D E0 12 6A
0FA1:20 B2 0F 18 20 0A E5 AD 82
0FA9:DE 12 AE DD 12 20 CD BD D9
0FB1:60 38 A9 0F ED DF 12 8D D4
0FB9:E1 12 A9 27 ED E0 12 0D 19
0FC1:E1 12 90 3D C8 38 A9 E7 9D
0FC9:ED DF 12 8D E1 12 A9 03 9F
0FD1:ED E0 12 0D E1 12 90 29 D3
0FD9:C8 38 A9 63 ED DF 12 8D 76
0FE1:E1 12 A9 00 ED E0 12 0D CE
0FE9:E1 12 90 15 C8 38 A9 09 64
0FF1:ED DF 12 8D E1 12 A9 00 C4
0FF9:ED E0 12 0D E1 12 90 01 D3
1001:C8 60 18 6D DD 12 8D DD A7
1009:12 AD DE 12 69 00 8D DE DF
1011:12 20 91 0F 60 20 4E 0F 94
1019:38 AD DA 12 E9 01 8D DA 86
1021:12 AD DB 12 E9 00 8D DB 98
1029:12 60 18 AD DC 12 69 01 4B
1031:8D DC 12 20 72 0F 60 38 5C
1039:A9 E7 ED DA 12 8D E1 12 30
1041:A9 03 ED DB 12 0D E1 12 0D
1049:D0 05 A9 30 8D C7 07 38 1D
1051:A9 63 ED DA 12 8D E1 12 27
1059:A9 00 ED DB 12 0D E1 12 64
1061:D0 05 A9 30 8D C8 07 38 39
1069:A9 09 ED DA 12 8D E1 12 A8
1071:A9 00 ED DB 12 0D E1 12 7C
1079:D0 05 A9 30 8D C9 07 60 7D
1081:A0 00 A9 20 99 00 04 99 97
1089:00 05 99 00 06 99 98 06 EB
1091:C8 D0 F1 60 A9 30 85 34 DB
1099:85 38 AD 0E DC 29 FE 8D 38
10A1:0E DC A5 01 29 FB 85 01 0A
10A9:A9 00 A0 00 B9 00 D0 99 BB

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10B1:00 30 B9 00 D1 99 00 31 3B
10B9:B9 00 D2 99 00 32 B9 00 E6
10C1:D3 99 00 33 B9 00 D4 99 76
10C9:00 34 B9 00 D5 99 00 35 78
10D1:B9 00 D6 99 00 36 B9 00 8F
10D9:D7 99 00 37 C8 D0 CD A5 8A
10E1:01 09 04 85 01 AD 0E DC 55
10E9:09 01 8D 0E DC 18 AD 18 1C
10F1:D0 29 F0 69 0C 8D 18 D0 11
10F9:A0 00 B9 71 11 99 80 31 D9
1101:C8 C0 50 D0 F5 A0 00 A2 A3
1109:00 A9 00 20 55 11 20 5E 25
1111:12 CA CA 20 5E 12 E8 A9 01
1119:00 20 55 11 C0 80 D0 E9 92
1121:A0 00 A2 00 A9 00 99 38 A0
1129:37 C8 20 71 12 20 71 12 3A
1131:20 71 12 A9 FF 99 38 37 AA
1139:C8 99 38 37 C8 99 38 37 F4
1141:C8 99 38 37 C8 C0 40 D0 43
1149:DB A0 F7 A9 FF 99 01 37 BA
1151:C8 D0 FA 60 99 78 37 C8 57
1159:99 78 37 C8 99 78 37 C8 BF
1161:99 78 37 C8 60 20 68 12 48
1169:20 68 12 20 68 12 CA 60 7B
1171:00 7F 7F 63 63 63 7F 7F C0
1179:00 1C 3C 6C 0C 0C 7F 7F FF
1181:00 7F 7F 03 7F 60 7F 7F 9F
1189:00 7F 7F 03 1F 03 7F 7F 2F
1191:00 66 66 66 7F 7F 06 06 8C
1199:00 7F 7F 60 7F 03 7F 7F 18
11A1:00 7F 7F 60 7F 63 7F 7F A1
11A9:00 7F 7F 03 03 03 03 03 F8
11B1:00 7F 7F 63 7F 63 7F 7F E1
11B9:00 7F 7F 63 7F 03 03 03 F2
11C1:FF FF FF AA AA AA 99 99 5B
11C9:99 66 66 66 E7 C3 81 7E 55
11D1:3C 18 E7 E7 E7 18 18 18 7B
11D9:A0 00 A9 FF 99 98 07 A9 68
11E1:A0 99 98 DB C8 C0 50 D0 FA
11E9:F1 A2 18 A0 01 18 20 0A 6D
11F1:E5 A9 FA A0 11 20 1E AB CB
11F9:60 96 20 54 49 4D 45 3A 7F
1201:30 30 30 30 20 1D 20 53 5B
1209:43 4F 52 45 3A 30 30 30 64
1211:30 30 30 20 1D 20 4C 45 A8
1219:56 45 4C 3A 30 30 30 20 A9
1221:00 A9 04 A0 00 99 00 D8 79
1229:99 00 D9 99 00 DA 99 98 26
1231:DA C8 C0 00 D0 EF 60 A9 BD
1239:00 8D F6 12 8D F7 12 20 51
1241:6D 0B A9 01 8D F6 12 A9 3A
1249:02 8D F7 12 20 6D 0B A9 68
1251:02 8D F6 12 A9 04 8D F7 4A
1259:12 20 6D 0B 60 A9 FF 99 30
1261:78 37 C8 20 66 11 60 BD A0
1269:C1 11 99 78 37 E8 C8 60 BC
1271:38 A9 FF FD C1 11 E8 99 B9
1279:38 37 C8 60 A0 01 18 20 FF
1281:0A E5 A9 77 A0 09 20 1E 58
1289:AB 60 20 81 10 20 22 12 0F
1291:20 37 0F 20 6F 0E 20 02 6D
1299:0B 60 18 A5 FB 69 2B 85 1A
12A1:FB A5 FC 69 00 85 FC 60 D3
12A9:A9 00 8D DD 12 8D DE 12 C8
12B1:A9 0F 8D F5 12 A9 02 8D 48
12B9:E2 12 8D E3 12 A9 F7 8D 78
12C1:E6 12 A9 01 8D DC 12 8D B4
12C9:F8 12 8D F9 12 8D FA 12 0F
12D1:A9 08 8D E4 12 20 38 12 60
12D9:60 00 00 00 00 00 00 2E

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ONLY ON DISK

In addition to the type-in programs found in each issue of the magazine, *Gazette Disk* offers bonus programs and original 64 and 128 artwork. Here are this month's bonuses.

Connect the Letters

Richard J. Sands
Atlanta, GA

This version of a popular paper-and-pencil game is played on a grid of five rows by five columns with 25 letters. The object is to draw horizontal and vertical lines that connect the letters. You and the computer take turns drawing one line at a time. You win a square when you draw the line that completes it. The player with the most squares wins.

Sport Card Collector

Kevin Scott Davis
Winter Park, FL

To help you use *Sport Card Collector*, we have included a partial listing of the author's basketball card collection.

You may order this disk (\$9.95 plus \$2.00 shipping and handling) from Gazette Disk, COMPUTE Publications, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408.

TYPING AIDS

MLX, our machine language entry program for the 64 and 128, and *The Automatic Proofreader* are utilities that help you type in Gazette programs without making mistakes. To make room for more programs, we no longer include these labor-saving utilities in every issue, but they can be found on each *Gazette Disk* and are printed in all issues of *Gazette* through June 1990.

If you don't have access to a back issue or to one of our disks, write to us, and we'll send you free copies of both of these handy programs. We'll also include instructions on how to type in Gazette programs. Please enclose a self-addressed, stamped envelope.

Write to Typing Aids, COMPUTE's Gazette, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408.